Part 1

Financial Modelling Structure and Design

Structure and Mechanics of Developing Financial Models for Corporate Finance and Project Finance Analysis

Chapter 1: Financial Modelling and Recurring Valuation Nightmares – Problems that Financial Models Cannot Solve

An inevitable step in just about any financial analysis these days is making some kind of explicit or implicit projection of cash flow and/or earnings and/or financial ratios that measure credit quality or profitability. Since valuation of debt or equity is all about making forecasts of these items, you could go to a fortune teller or read the astrology section of your on-line newspaper to make a prediction of the future. These days however, forecasts used in valuation are more often founded on fancy financial models built using elaborate spreadsheets. After bursting of the dot com bubble in 2000, the global financial crisis of 2008, the European debt crisis in 2010, the East Asian crisis of 1997 and innumerable other less famous valuation disasters where debt and equity investment failures had relied on sophisticated financial models, it could be argued that going to astrologers and fortune tellers would have been a better strategy. Notwithstanding serious questions about the overall efficacy of making financial projections, the fact is that financial models are becoming more and more complex and are also being used more than ever before in all types of investment analysis. Seemingly sophisticated models using elaborate programming functions can appear impressive and even artistic, but at the same time be almost impossible to use in assessing risk and value. Given the prominence of modelling in financial analysis, this part of the book describes how to build flexible, accurate, structured and transparent financial models that can be used to assess various different valuation problems.

When considering many valuation mistakes made in the past decades, the most important pitfall in modelling is the development if economic assumptions for prices, volumes, capital expenditures and operating expenses that are put into the models. If you take a step back and think about all sorts of financial failures ranging from the global financial crisis to bankruptcies of small business enterprises to industry specific failures such as solar panel manufacturers, there are a few patterns of mistakes that are repeated over and over again and that seem obvious after the fact. Before delving into sophisticated mathematical equations, excel techniques and model structure issues that deal with methods to resolve difficult project and corporate finance and project finance modelling challenges, it is a good idea for you to think about why the outcomes of financial analysis using financial models sometimes fails so miserably. You can then leave these ideas somewhere in the back of your brain while you create the ornate excel models that follow all of the rules about flexibility, accuracy, structuring and transparency.

Some recurring valuation mistakes related to financial modelling that continue to be made despite more and more sophistication in financial analysis include:

(1) Making assumptions in financial models that business entities which are earning a rate of return substantially higher than their cost of capital and are growing quickly can continue this financial performance for a long time even when they do not have some kind of sustained competitive advantage. Earning a higher return than the cost of capital and growing seems to put a company in the famous powerhouse square on management consultant power point slides that is supposedly the best place to be for valuation. But when returns and growth are high, valuations are also high. More importantly, other companies from all over the world will attempt to enter the industry no matter how unique the company claims to be. New capital expenditures often leads to industry-wide over-capacity followed by reduced prices and sudden dramatic declines in returns. If demand growth is slower than expected which happens more often than not, the over capacity and depressed prices can last for many years and the company is suddenly on the worst box. Examples of high growth and returns leading to industry expansion followed by surplus capacity and price crashes – the most basic economic principles -- include the famous telecom industry meltdown in the late 1990's; the merchant electric power crash of 2000-2001 in the U.K where virtually every electricity plant without a fixed price contract defaulted on its debt; the real estate industry during many periods most notably before the U.S. crash of 2008; very high returns earned by solar manufacturing companies followed by massive new entry and dramatic price declines after

Chinese manufacturers entered the industry; high returns earned by bulk cargo vessels before 2008 followed by overcapacity and depressed prices that have continued long after commodity prices and other industries recovered; and depressed occupancy rates and room rates for hotels in Iquitos Peru that followed a period of over-building that was supposed to occur because of the region receiving UNESCO heritage site status.

(2) Entering projected prices in financial models that remain above the long-run cost of production even when capacity is increasing in an industry. One can define a price bubble as a situation where prices do not equal long-run marginal cost and/or values are not consistent with levels that provide investors with a reasonable return on their investment. Assuming that prices can be sustained above marginal cost happened before the U.S. real estate crash where people believed they could profit by buying and selling (or flipping) homes; it occurred during the famous Tulip bubble in Holland in the 17^{th} century; it may be happening in U.S. natural gas prices above the marginal cost of producing shale gas; and the assumption that prices could remain above marginal cost was behind just about all of the valuation mistakes discussed in the last paragraph ranging from the telecom industry crash to overproduction of container ships.

(3) Using information in financial models that relies on so-called independent experts whether these people or institutions are credit rating agencies, large reputable corporations, consulting companies that create very fancy models, experts speaking on television, famous finance professors, or former politicians. Many valuation nightmares have demonstrated after the fact that it is more important to visit countries, meet with real consumers, try out products and services, and have a through independent understanding the business idea than relying on so-called experts when developing projections. Reliance on entities like rating agencies was not only a cause of the global financial crisis of 2008, but has also occurred with traffic studies made for project financings such as the Eurotunnel, toll roads and toll bridges all over the world, theme parks and countless other cases. The famous Panama Canal catastrophe where French investors lost so much money in the 19^{th} century resulted from trusting a famous engineer who had only visited Panama once. Relying on the reputation of companies that were thought to be the most innovative in their industry like ENRON, Worldcom and Lehman Brothers without thinking through the fundamental economics turned out to be very dangerous.

(4) Trusting financial model results where increasing returns are projected by a company but the returns only come about because the company is taking on increased risks. Companies with declining returns or lower margins than their peers often desperately try increase or maintain equity returns. But these companies (or individuals) can generally only meet their return objectives by incurring increased risks and then trying to hide those risks using the latest business jargon and/or creative accounting. When taking on new ventures or deploying capital that involves taking greater risk, it is tempting for companies to directly or indirectly cover up the risks through not fully disclosing things or worse, using very sophisticated and confusing financial language along with financial models that are impossible to understand. Examples of valuation errors caused by presenting confusing information include Constellation Energy in 2006-2008, Enron's impossible to understand financial statements and innumerable financial institutions that made risky loans or engaged in risky trading behaviour to boost their returns before the financial crisis.

(5) Ignoring shifts in the cost structure and demand changes which can quickly render existing assets obsolete. This is a particular problem in modelling oligopolistic industries where seemingly stable returns and cash flows can suddenly change on the whim of management actions or changes in consumer taste. Think about Nokia, Research in Motion (blackberry) and Apple. A few years ago Nokia was the rage of investors and the company was assumed to have unique products that would yield a sustainable competitive advantage and strong returns over an indefinite period. Then Nokia lost its lustre and Research in Motion was the poster child for investors. A few short years later, RIM lost its popularity and Apple became

the most valuable company in the world as it somehow made people even more addicted to their cell phones. Commodity industries may be very volatile and not offer extraordinary returns, but at least you can apply basic economic principles when thinking about prices volumes, industry capacity and market demand.

(6) Putting faith in fancy, complicated and innovative new financial paradigms when creating financial models. At the turn of the century the so called new economy was supposed to replace traditional analysis using cash flow and rate or return relative to cost of capital. New economy principles could explain why dot com companies do not need cash flow or profit to generate value; real option models were used to justify new peaking power plants that did not make economic sense using traditional discounted cash flow analysis; collateralised debt obligations could supposedly could somehow reduce risk by putting a bunch of skanky loans to people who could not repay them. When such new models cannot be explained in simple terms and when the seemingly sophisticated financial models explain why one can somehow earn high returns without having a sustained competitive advantage, they almost always turn out to be rubbish.

(7) Having confidence in contracts that do not make economic sense and incorporating those contracts in financial models. Financial contracts that turned out to be unsustainable included sub-prime loans issued before the financial crisis, electricity contracts called PPA's in Senegal, India, Indonesia, the U.S.; the Philippines and many other places; construction contracts for large complex projects such as Eurotunnel and Eurodisney that chronically underestimated the actual cost; oil projects where ownership structures resulted in extreme economic profit for private investors; and, financial subsidies from governments in Spain and the Czech republic that lead to very high returns for project developers. In each of these cases financial projections made by analysts assumed contracts that would remain in place even though the contracts allocated risks in crazy ways and lead to prices and returns that were far away from economic reality.

(8) Inputting symmetric upside case and downside assumptions in models without adequately considering differences in upward limits and downward exposures that create skewed returns. Not properly accounting for deviations between upside and downside variation led to the California crisis in electricity prices in 2000-2001; underestimating exposure to risk of nationalisation when oil prices are low; retiring large plants when prices are low and have much more potential movement to the upside than to the downside.

Chapter 2: How to Read this Book in Different Ways so You Can Learn Rigorous Valuation Techniques and Become a Black Belt Modeller

The four parts of this book explain how to: (1) build and interpret corporate finance, project finance and acquisition financial models; (2) perform risk analysis using all kinds of financial models; (3) analyse multiples, terminal values and normalised cash flow in deriving value from corporate models; and, (4) use mathematical programming to resolve circular calculation problems in corporate and project finance models. While the descriptions along with practical exercises of these subjects will hopefully help you to avoid some of the famous pitfalls discussed in the last chapter, mechanical construction of the best financial models in the world has little direct effect on the recurring human mistakes discussed above. Because of the importance of the recurring valuation mistakes, the introduction to various subjects in the four parts of the book will periodically return to these issues.

In describing model structure, risk analysis, valuation and circularity this text discusses corporate finance models, project finance models and acquisition models. You may wonder whether the subject is too broad and if some of the intricate issues that arise in different modelling contexts can all be adequately addressed in a single book. The philosophy of discussing different types of models and valuation analyses is that you can learn creative modelling techniques and understand why certain model

structures are used through contrasting the different types of financial models. Further, while one can make generalisations about the different modelling categories, many transactions and analyses have overlapping aspects of project finance, corporate finance and acquisition finance. An investment may be initially structured using project finance concepts; it may then gain characteristics of a corporate finance analysis as it develops a history and expands into other activities. After the corporation has existed for a few years it may consider acquiring new companies requiring acquisition analysis.

As much of this text is designed to be a practical reference guide on how to structure and build models there are a number of ways to read the book. One way is to read through different chapters without touching an excel sheet. This may not be very exciting and would be something akin to reading a cook book without trying out the recipes. A second way to read the book is to work through one of the many of the accompanying models while you tackle the various issues. More than a two hundred customised exercises with instructions along with template project finance, corporate model templates and acquisition model templates are included on the associated web site www.edbodmer.com. There are many completed example models that may be the most helpful tools in learning how to become a truly top notch modeller. These exercises, template models and completed model examples on the website are an integral part of this book. A third way to use this book if you already have experience in modelling is to treat it as a reference manual where you can selectively look up difficult modelling issues such as modelling a debt service reserve account without any circularity or writing a function to deal with retirements of assets and accelerated depreciation.

Probably the only real way to learn financial modelling is working late at night under a tight deadline under the pressure of a transaction. Real modelling is not a linear process, but involves gathering information, focusing on data that is relevant and coming up with ways to best represent the revenues and earnings of a business given sometimes very limited available information. The process of developing the top line, revenue from volume sold and capacity, is and certainly should generally be, the most time consuming and important part of the model that requires a lot of time and creative thinking. Notwithstanding the non-linearity of the real-world modelling process, outlining the structure of models and presenting real world examples in this chapter can provide a head start for those who have not built models and will eventually have to learn the hard way.

The principal objective of this part of the book is to provide you with practical instructions on how to build a well structured financial model that clearly delineates inputs, effectively presents key value drivers, uses separate modules to organize various components in a logical manner, accurately computes cash flow that is available to different debt and equity investors, and presents results of the analysis that effectively represents risks of the investment. A bit of theoretical discussion of how different types of models can be used to establish value is discussed for many issues, but the main objective is simply to provide details on how to build better models. In discussing the process for building an efficient financial model, this part of the book is organized into the following sections which correspond to general structure of a financial model:

- Model objectives and the general notion of keeping models simple
- Structure and layout of alternative types of models
- Avoiding bad spreadsheet programming practices
- Organizing time periods in a model
- Projecting revenues, expenses and capital expenditures in a working analysis
- Developing free cash flow through computing depreciation expense and working capital
- Programming the debt schedule and incorporating cash flow waterfalls that establish the priority of payments to different capital providers
- Creating the financial statements projected tax payments
- Performing different types of risk analysis
- Programming difficult project finance issues associated with sculpting, DSRA, funding and re-financing
- Including stable ratios and implied multiples in corporate models to accurately measure terminal value

Some of the subjects discussed in this chapter such as organizing time periods of the model, using techniques to verify the accuracy of mechanical calculations and computing tax depreciation are not very glamorous. While these topics may not have dramatic effects on valuation, use of good modelling practice can improve the efficiency of the process and allow you to spend more time on the important issue of risk analysis. There are many practitioners who have created models the wrong way for a long time who can attest that a few simple ideas regarding structuring and programming models can dramatically improve the operation of a model and ultimately improve valuation analysis.

Chapter 3: General Model Objectives of Structuring Transactions, Risk Analysis and Valuation and Keeping Models as Simple as You Possibly Can

Financial models have three general objectives that should be placed in the back of your mind before you start writing any excel formulas or developing any assumptions. These are: (1) coming up with the expected value of an investment; (2) assessing the risk of the investment; and (3) developing the financial structure of a transaction. Effective assessment of risk is the centrepiece of valuation and the most fundamental reason any financial model is created. Believing that all risks can be avoided in any aspect of your life is dangerous and generally leads to poor judgment and bad decisions. Taking measured risk is a fundamental fact of life and in economic analysis financial models can hopefully help your judgment in accepting risk. Once you have attempted to measure risk, you can see what kind of debt and value correspond to the risks in a particular transaction. This leads to the final and aspect of valuation that derives of implied value or cost of capital through measuring debt capacity and/or a set of financial statistics such as P/E ratios.

Given the importance of risk analysis in valuation, one of the two central objectives in building a model of future cash flows is to assess risks in a transaction, whether the transaction is simply purchasing a stock, borrowing money, investing in an airport, acquiring a company or signing a contract. The second general objective of building a financial model corresponds to the inference of risk from debt capacity and structuring of transactions mentioned above. Structuring a transaction using a financial model as a tool may mean sculpting debt repayments in a project financing transaction, sizing the senior debt in a leveraged buyout, developing the share exchange ratios in a merger or simply evaluating the reasonableness of P/E ratios when valuing a stock. Depending on the valuation approach, the analysis may address risks to equity holders, risks to senior debt providers or risks to other parties such as contract counterparties. Finally, even if you are an “excel phoebe” you should be able to understand financial models and make informed decisions about the risk of a security.

After the financial crisis of 2008 some have suggested that risk analysis of complicated investments is simply too difficult and opaque for average investors to understand. Investment bankers had supposedly created dangerous overly-complex products that could not be modelled or analysed. To model risks of these structured investments (so named because they split-up or structure operating cash flows to different investors) financial models had to be created that not only measure operating cash flow, but also who gets the cash flow in what order in alternative states of the world. Modelling the risks of CDO’s was famous for being “confusedly elegant” and relying on complex statistics that are all but impossible to interpret. The outputs of fancy statistical analysis was sold as really representing economic behaviour and sophisticated models that measured value at risk and the probability of default gave people a false sense of comfort that they could take risks which in hindsight turned out to be silly. By working through the financial modelling mechanics in this chapter, you should see that valuation errors made because models or studies are incomprehensible are no excuse for poor risk assessment. Building a financial analysis were one sees which investor receives cash flow in what order and then performs risk analysis even for a toxic collateralized debt obligation is not difficult if you are careful with the structure of the model. Financial modelling is not very complex or mysterious even though financial modellers sometimes seem to be involved in a conspiracy that makes the analysis impossible to understand. Hopefully, the

modelling discussion follows Warren Buffet's comment that: "Business schools reward difficult complex behaviour more than simple behaviour, but simple behaviour is more effective."

In order to manage the discussion of different modelling issues associated with risk analysis and debt structuring, financial models are broadly categorized into three different types for purposes of the discussion – deterministic models, stochastic models and back of the envelop models.

Deterministic Models: Deterministic models are the kind of models most of us are familiar with. Even with all of the methods presented below to make the models transparent and logically structured, these deterministic models can become large and difficult to audit. Risk analysis in deterministic models is generally computed using judgmental assessments about how selected variables can change relative to base case assumptions.

Stochastic Models: Stochastic models build on deterministic models but include probability distributions around key variables. The probability distributions depend on relatively sophisticated mathematical analysis of economic variables and their correlation with one another. After the stochastic variables are added to a financial model, one can compute probability distributions associated with key valuation measures such as rate of return or probability of default.

Back of the Envelope: Simple back of the envelope models can be more important than the other two model types. These models may involve developing some kind of metric to check whether the complex model results are reasonable or they may involve simple statistical checks of the valuation. For example, in valuing a hotel one could calculate the value per room and assure it is reasonable relative to the costs of other similar hotels. Alternatively you may compute the return on investment on a year by year basis and think about whether it is really possible to earn the returns given the competitive structure of the industry. Coming up with effective ways to make simple analysis that checks a model can require more creativity and be more difficult than the other models.

Large deterministic and stochastic models built in excel generally receive the most attention when making valuations while simple back of the envelope models seem to be less and less part of the process. The description of modelling methods in this chapter and the next do address the first two model types: deterministic models and stochastic models without emphasizing the importance of making simple checks of the reasonableness of the result. This however does not in any way mean that back of the envelope models should be considered less essential in the valuation process. In fact, developing simple models – and simple is in no way synonymous with easy -- may be more important than any of the other analyses. Proving a valuation concept with a relatively simple analysis should take place at both the beginning and the end of the analysis.

Chapter 4: The Structure of Alternative Financial Models: Common Features and Differences in Layout of Financial Models for Project Finance, Corporate Finance and Merger and Acquisition Analysis

In developing any deterministic financial model it is essential to think about the architecture of spreadsheet before you begin to enter data or write any excel formulas or make any valuations,. This idea of coming up with the structure applies to virtually any analysis in finance, economics or for that matter science and engineering. It involves (1) carefully organizing the inputs, (2) understanding mathematical calculations and (3) presenting outputs. The general design of a financial model involves deciding on how to organize the inputs from various information sources in an structured manner; how to formulate the mechanical calculations in a transparent way that is easy to audit and understand; and, finally how to present the outputs so that purposes of risk assessment and valuation. Other than these

basic elements of structuring the inputs, calculations and outputs of a model, subjects that should be considered in laying out the architecture of a model are the programming of time periods, the methods for verifying model accuracy and the setting-up of alternative scenarios. Much of the process in developing an effective model is simply putting things in an order that makes sense and understanding the starting point of the model.

One of the most influential and lasting ideas in finance has been the work of Modigliani and Miller in 1958 who suggested that the focus of valuation should be on aggregate free cash flow that can be distributed to debt, equity any other investors rather than the way the cash flow is split up between alternative investors. If you really still believe the theory developed by Modigliani and Miller that debt and other forms of financing does not make any difference in the way real world investments are made, or that debt does not influence valuation, then you should then stop all of your financial models after computing EBITDA, capital expenditures, working capital changes and taxes on operating earnings (EBITDA, capital expenditures and working capital changes are the components of the typical definition of free cash flow). There is no need to worry much about the financial structure of a model and create an income statement or compute earnings per share, equity cash flow, debt service coverage or a balance sheet. You can only focus on operating cash flow less taxes that must be paid before any money is paid to investors; capital expenditures that must be made to sustain operations; and, working capital changes adjust EBITDA to reflect true cash flow. Although calculating prices, demand, cost structure and the cost of new capital equipment – the drivers of unleveraged free cash flow -- is the most important aspect of any model, almost all of the valuation techniques described later in the book require analysis of items in addition to free cash flow. When financing is explicitly considered, models may concentrate on earnings after interest and/or debt and equity cash flows (after debt service) and/or financial ratios such as Debt/EBITDA that include balance sheet items. Therefore, much of the discussion of financial models in this chapter considers the financial structure of a company or project and the distribution of free cash flow to debt investors, equity investors and income taxes.

The layout and ordering of items in a deterministic financial model to a large extent depends on the type of investment being assessed. Most financial models can be classified into five general categories -- corporate models, project finance models, acquisition models, merger integration and real estate models. Because of different data sources and alternative valuation techniques, the layout of financial models is different for each of these model types. The valuation techniques, data sources and outputs of these models can be summarized as follows:

Corporate Model: The distinguishing feature of the first and most common model type, a corporate model, is that a corporation has a history and it is assumed to last indefinitely (although virtually all companies will either end up in bankruptcy or eventually be purchased.) This means that valuation of a corporation begins with historic analysis and the models must include some kind of terminal value assumption. The terminal value calculation is necessary because it is not reasonable to make detailed forecasts of cash flow item for the indefinite life of the corporation which would require forecasts for fifteen to fifty years into the future. An important objective in corporate models is often the projection of earnings per share since this is the number that drives valuation by many investment analysts.

Project Finance Model: The second type of model for a project finance transaction differs from a standard corporate model because the investment is characterized by different phases that have different risks; the fact that no history on cash flows exists for the investment (no matter how many times a similar new combined cycle plant is built, you don’t know how it will work until you switch it on); and the isolation and quantification of particular risks. Rather than spending time on studying history, project finance analysis involves evaluating consulting studies and engineering reports such as traffic studies, price forecasts and marketing analyses. The project finance models focus on cash flows accruing equity holders and lenders rather than earnings and the projections generally cover the entire defined lifetime of the project.

Acquisition Model: The third type of model, an acquisition or leveraged buyout model, measures the returns earned from an acquisition transaction that involves the consideration paid for the equity of the company, the holding period of the investment and exit price as well as the manner in which the acquisition is financed. To compute equity returns, acquisition models measure the manner in which alternative financing sources are repaid and ultimately compute the return earned by equity investors. The information base of evaluating an acquisition is the historic financial statements of a company along with management strategy after the transaction.

Merger Model: An integrated consolidation model computes earnings per share and credit quality measures on a standalone and a consolidated basis before and after a merger or acquisition. This type of model considers the specific financing and accounting of the transaction as well as cost savings or synergies generated by the transaction. A common application of this type of model is to evaluate how much can be paid for a company before earnings dilution will occur and bond ratings can be maintained.

Real Estate Model: A real estate model is a cousin of project finance models but also has many elements of corporate finance analysis. Rather than concentrating on a single investment, a group of multiple investments in a portfolio are often combined together. For example, a mixed development model includes different residential properties with different construction start and finish dates as well as different commercial and even industrial properties. Real estate models must be able to evaluate cash flows that are produced at different time periods without a single construction and operation period. Further the models must be able to quantify the effects of different holding period strategies and alternative tax treatments. Appendix 1 discusses the real estate models in more detail.

Each of the different model types has many principles and programming techniques in common. They each require up front thought as to the structure and the scope of the model; they each should have structured time lines; they each should be segregated into modules beginning with layout of operating and financing assumptions; they each should each have audit and verification procedures; they each should have a starting point; they each should not contain bad programming practices; and they each should be structured so as to facilitate effective risk analysis. However, each model structure contains unique complexities that can make the models difficult to understand, in-flexible, in-accurate, unorganized and un-stable. Differences between the structures of alternative model types are discussed below.

Structure of a Corporate Model to Recount the History of the Company and Make Forecasts that Include Sensible Outlooks of Key Drivers

Among other things, forecasts from corporate models are used to compute free cash flow and earnings for making valuations and to assess the credit quality of a company in the context of providing loans. Valuation from corporate models may use discounted free cash flow, evaluate earnings per share or it could be derived from equity cash flow. Loans may be assessed in a corporate model through gauging the ability to repay debt service from cash flow and/or evaluating the capability of the corporation to repay the loans through re-financing given a set of credit quality indicators such as debt to equity and/or debt to cash flow ratios and/or interest coverage.

The structure of a corporate model is directly associated with the idea that a company has a history and an indefinite lifetime (unlike a project finance investment that generally has no historic record and will end once the asset is no longer useful). Whereas a project finance analysis is analogous to a person's life or to a relationship -- both of which have a definite beginning and end -- a corporation is more analogous to a family, a country or city which may have seen better times or may have bright future prospects. The

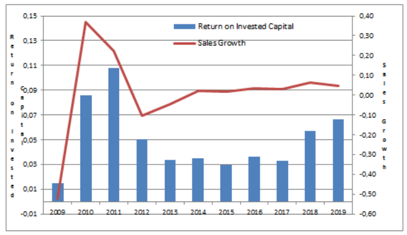
indefinite life of a corporation means that a financial model can only take a snap shot of the company that covers a portion of its history and also that the forecast must stop at some point while the company is still generating cash flows. It is usually impracticable to include all periods of history in the model and it would be silly to try to make a forecast that extents infinitely. But including enough history in a model so that you can make judgments about exposures to economic downturns and potential volatility in cash flow is an essential part of making a corporate model. When Winston Churchill observed: “The farther backward you can look, the farther forward you can see” he surely was not talking about the structure of a corporate financial model, but the quote is relevant to the structure of a corporate model. Perhaps the most prominent feature that differentiates corporate models from project finance models is incorporation of historic data and the ability to analyse both projected results alongside historic data.

Designing the structure of a model should follow a logical and natural progression beginning with history, moving to assumptions, computing operating cash flows and then adding debt financing. When setting up a corporate model, the structure should allow users of the model to easily make judgments with respect to whether assumptions are reasonable in the context of historical performance. As part of the historic evaluation, it is a good idea to present historic together with projected financial ratios such as return on invested capital, EBITDA margin and credit ratios in order to tell a story about what has happened to the company in the past and what you expect to happen in the future. By presenting financial ratios such as return on investment next to the key assumptions, you and others can quickly see if you made some nonsensical assumptions and your model is less of a black box. In addition to recounting a tale about what happened in the past, financial analysis of history provides a basis for comparing projections with actual results that can be used as a simple check on the reasonableness of a forecast. If the return on investment has consistently hovered between 8% and 10% and your forecast shows a return of 20% you better have a very good and simple explanation about what kind of special thing the company is going to do to earn the higher return.

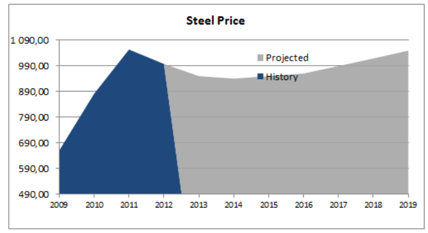
To illustrate how corporate finance analysis is centred on analysis of history and should be a narrative about the company, the excerpt below from the summary page of a corporate model shows how graphs of historic data is connected to assumptions and how the valuation is most effective when it is judged in light of historic and projected financial ratios. There is one graph that shows a couple of financial ratios together (in this case it shows sales growth and return investment corresponding to the fundamental idea of corporate finance theory that when returns exceed the cost of capital, it is good for investors to grow a company). A second graph shows the history and forecast for one of the key assumptions. The drop down boxes allow you to see a wide range of assumptions in the right hand side graph while the graph in the middle of the page shows he historic and projected return on invested capital along with the sale growth. These graphs are shown together with key operating assumptions and a summary of valuation and credit quality indicators.

Overall Scenario	Base Case	
Discretionary Capital Expenditures	300	
Dividend Payout	50%	
Custom Scenario: Production	Base Production	3,00%
Custom Scenario: Price	Base Price Case	820,00
Maintenance Cap Exp	Base Case Mainte	
Variable Cost of Revenue	62,00%	
Fixed Cost of Revenue	4%	
Selling Costs	5,85%	
Interest Rate	8,50%	
Valuation Year	2014	
Terminal Year	2020	
WACC	10%	
Terminal Growth	2%	
Terminal EV/EBITDA	8	

Sales Growth
Return on Invested Capital



2009
2019
Steel Price



	Stable Growth	EV/EBITDA Ratio	Value Driver
PV of Explicit Cash Flow	4 628,07	4 628,07	4 628,07
Add: Terminal Value	12 233,37	13 459,27	6 418,65
Total Enterprise Value	16 861,44	18 087,34	11 046,72
Less: Bridge	5 022,72	5 022,72	5 022,72
Total Equity Value	11 838,72	13 064,62	6 024,00
Shares	1 339,13	1 339,13	1 339,13
Value per Share	**8,84**	**9,76**	**4,50**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EBITDA	2 594,00	4 305,00	6 323,00	1 237,00	2 350,00	2 898,00	2 012,00	1 807,49	1 910,51	1 917,78	2 081,98
Funds from Operations	1 997,00	4 380,00	4 378,33	1 584,00	1 742,00	2 769,00	2 453,00	2 048,48	1 921,33	1 928,20	2 082,10
Less: Capital Expenditures	651,00	744,00	1 103,00	441,00	832,00	1 281,00	1 261,00	1 050,00	1 065,00	1 080,30	1 095,91
Cash Flow Before Financing	1 346,00	3 636,00	3 275,33	1 143,00	910,00	1 488,00	1 192,00	998,48	856,33	847,90	986,19
Less: Debt Service	256,00	450,00	712,00	717,00	741,00	725,00	668,00	2 402,07	1 541,80	1 889,71	2 288,03
Cash Flow Before Dividends	1 144,00	3 268,00	2 677,33	506,00	195,00	797,00	570,00	(1 339,30)	(661,36)	(1 020,26)	(1 279,85)
Less: Dividends	-	1 449,50	1 171,03	0,14	-	465,74	-	-	2,23	-	29,81
Net Cash Flow	1 144,00	1 818,50	1 506,30	505,86	195,00	331,26	570,00	(1 339,30)	(663,59)	(1 020,26)	(1 309,66)

Figure 1-1

In a corporate model, two very simple ideas can dramatically improve the structure of the model. The first is understanding that the starting point for all of the fixed asset accounts, debt accounts, working capital accounts, deferred tax accounts, accumulated depreciation accounts, surplus cash accounts, and other items come straight from historic balance sheet. The second is setting up separate accounts for all of these items where historic closing balances come from the historic balance sheet and projected amounts are often directly or indirectly derived from capital expenditure, revenue and expense forecasts. After painting a picture of the company using historic financial statement analysis, the structuring of forecasts in a corporate model involves defining how one incorporates history as well as prospective industry structure and economic assumptions to assess the value of a business. The mechanical process uses an historic balance sheet items and connects interest expense and interest income in the income statement to the balance sheet debt through evaluating the cash flow. The process of beginning with historic balance sheets and then working through each balance sheet item in distinct parts of the model produces a structure which should be transparent and accurate. The architecture of a corporate model is illustrated below:

Structure of a Standard Corporate Model

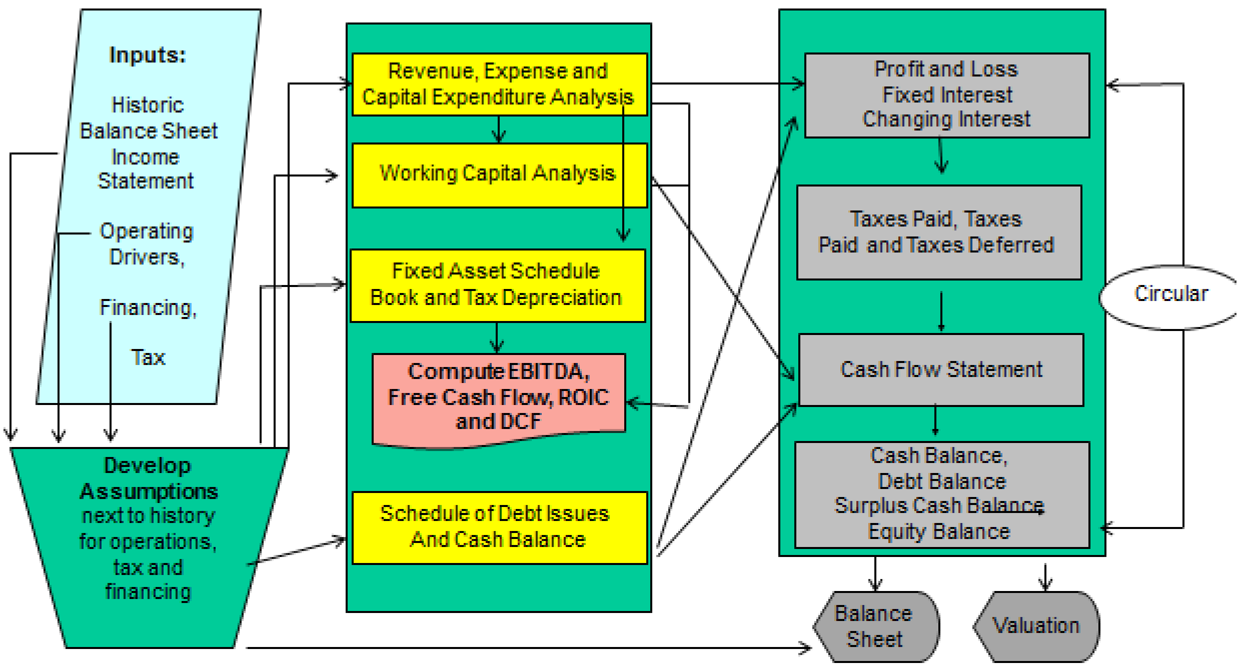


Figure 2

The diagram above is intended to illustrate some of the important points in structuring a corporate model. You generally begin with analysis of history and the using historic balance sheets to set-up accounts. The working analysis, the fixed asset balance and the debt schedule are the essential intermediate steps that should be completed before even thinking about constructing financial statements. Developing revenues, operating expenses and capital expenditures in the working sheets is just about always the most important part of the analysis. When making forecasts of revenues, expenses and capital expenditures it is generally a good idea to graph history and projections of key variables that drive these three things such as prices, market share, industry demand growth, capacity utilization, variable costs and capital expenditures per unit. Once the operating analysis, depreciation, and debt analysis are complete, financial statements can be constructed. Most of the components of financial statements such as revenues, depreciation and interest expenses have already been in separately structured sections, this part of the analysis should be quite simple.

One of the main computational challenges in a corporate model is to determine how surplus or deficit cash should be deployed and to develop projections of depreciation and deferred taxes that account for the lifetime of different asset classes. The diagram below illustrates that connection of the profit and loss statement with the interest expense and interest income that is a typical characteristic of a corporate model (that creates a circularity problem). The arrow on the right hand side of the diagram is meant to show that interest expense on new debt calculated from the model is not known until the debt balance is computed from the cash flow and interest income on surplus cash is not known until the amount of surplus cash is derived. Unlike project finance models where any extra cash flow is distributed, in a corporate model, dividends are typically determined from an algorithm such as a payout ratio and are not the result of the cash flow process.

The final parts of the diagram show that the balance sheet should be an output of the model rather than part of the mechanical calculations. To construct a projected balance sheet, the common equity balance can be calculated from historic balance sheet data long with projections of net income and dividends as

with the other balance sheet accounts (a similar account can be computed for minority interest.) With all of the accounts completed including the equity balance, the balance sheet can then be tabulated by simply gathering together the closing balance of all of the accounts. Then you can be so very happy to see that your balance sheet is in balance for every single period of the model. Much of the remainder of this part of the text is structured to work through each part of the model shown in the diagram above: there is a separate section devoted to discussing economic, financial and modelling issues associated with the input section; the operating or working section; the debt schedule; the profit and loss statement and the cash flow statement.

Some of the computational challenges in corporate models include:

- Development of effective assumptions that include industry supply and demand and conversion of capacity, demand and market share into revenues, expenses and capital expenditures;

- Flexible incorporation of historical financial data to accept updates when new financial data become available;

- Modelling projected depreciation expense with asset retirements, deferred taxes and net operating losses;

- Computing stable ratios of depreciation to net plant, capital expenditure to depreciation, deferred tax to capital expenditure and EV/EBITDA ratios in computing terminal value;

- Including target capital structures in the models rather than assuming net cash flow builds up cash balances or accumulates debt; and,
-
- Dealing with unfunded pensions, derivative assets and liabilities, stock options, intangible assets and other items.

Use of the INDEX function in Corporate Models

In describing various modelling issues, this book is structured by first discussing conceptual issues associated with financial and economic modelling and then presenting practical spreadsheet methods to implement the ideas. To demonstrate the manner in which analytical methods are presented, the INDEX and the MATCH functions are introduced in this section. For a corporate model, one of the most useful spreadsheet functions is the INDEX function. Among other things, the INDEX function allows development of scenario analysis; it can be used to create graphs of all of the assumptions with dropdown boxes; and, it permits you to make flexible valuation analysis with different valuation start dates.

The INDEX function does nothing other than finding the value of a cell in a given area after defining a row, a column or both a row and a column (it could be called the find function, but the find function is used in working with strings). One of the most effective ways to use the INDEX function is to select an entire sheet and then provide the row and column number to find a value in the sheet or to select an entire column (row) of data and provide the row (column) number to find a value as shown below:

Value = INDEX(Defined Area, Input Row of Area, Input Column of Area)
Value = INDEX(Entire Sheet, Input Row of Sheet, Input Column of Sheet)
Value = INDEX(Defined Column, Row of Column Area)
Value = INDEX(Entire Column, Row in Sheet)
Value = INDEX(Defined Row, Column of Row Area)
Value = INDEX(Entire Row of Sheet, Column in Sheet)

The way different ratios, assumptions or historic items can be selected for making a graph in a corporate model is to find the row or the column for the item using the MATCH function. Say the word REVENUE is

in the fourth row of the sheet as shown in the example below. The MATCH function can give you the number 4 if you enter the formula below:

Row of Sheet = MATCH("REVENUE", Entire Row of Titles, 0)

The MATCH function can also be used to give you the column number and it is not necessary to use the MATCH function with an entire row or an entire column. The zero in the above formula is used as an option that specifies the exact value must be found (this is discussed in more detail below).

Once the Row is defined from the MATCH function, the INDEX function can be used with multiple different columns. This is done by copying the INDEX function and fixing the row number (using the F4 short-cut key to fix the row number in different columns). In presenting analysis techniques, an excerpt from a spreadsheet is often presented to illustrate how the process works. The excerpt below shows how the MATCH and INDEX functions can be used with the data validation feature in excel to pick alternative variables in a sheet. After the INDEX is defined a graph is created with the ALT and F1 short-cut key. The example demonstrates that the MATCH and the INDEX functions are like brothers. As you become a spreadsheet wizard, you should show your prowess by stating how you use the MATCH and INDEX functions to differentiate you from an unsophisticated users.

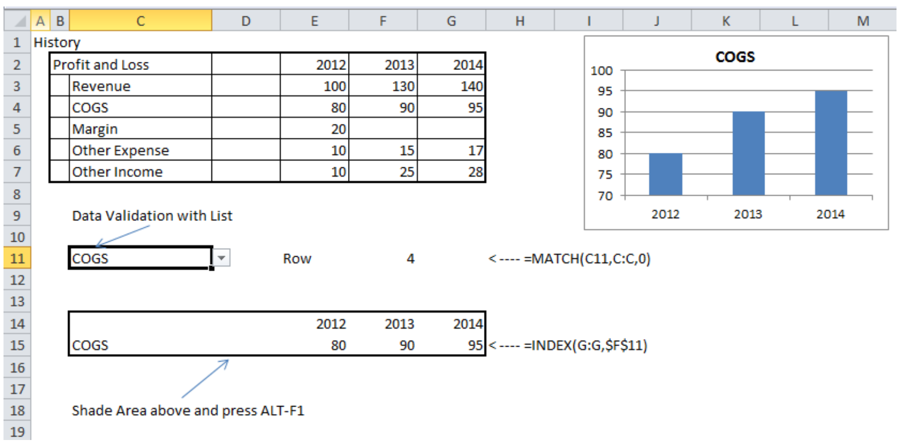


Figure 3

Making the Painful Process of Acquiring Data from a PDF File Easier

When making forecasts in the 1980's you had to ring the company on the phone and ask for the annual reports to be sent after which you had to manually type in all of the data. Life is better now but certainly not perfect. You can directly download data from free websites or you can pay a lot of money to Bloomberg for the data but invariably you still need to use some data from the annual report of a company that is not in a nicely structured spreadsheet but instead part of a pdf file. Copying data from a pdf file into excel results in a mess where words are in different cells and numbers are not in consistent columns (sometimes the items are not in different cells which means you should use the text to columns option in the excel data menu). The data may look something like the format below:

Notes	2008	2007	2006										
ASSETS													
Non-curre	assets												
Property,	plant	and	equipmer	9,00	$	9,01	$	10,11	$	3,66			
Intangible	assets	other	than	goodwill	10,00	885,00	806,00	37,00					
Goodwill	5,00	2,39	2,15	112,00									
Investmer	in	joint	ventures	and	associates	11,00	551,00	592,00	1,49				
Deferred	income	tax	assets	8,00	44,00	22,00	11,00						
Other	non-curre	assets	13,00	278,00	240,00	272,00							
13,16	13,91	5,58											
Current	assets												
Inventorie	14,00	2,42	1,62	864,00									
Trade	and	other	receivable	15,00	1,37	1,80	556,00						
Prepayme	76,00	196,00	82,00										
Loans	receivable	108,00	48,00	19,00									
Receivabl	from	related	parties	16,00	137,00	60,00	54,00						
Income	tax	receivable	262,00	86,00	51,00								
Other	taxes	recoverab	17,00	397,00	351,00	331,00							
Short-terr	investmer	18,00	589,00	25,00	25,00								
Cash	and	cash	equivalen	19,00	930,00	327,00	842,00						
6,28	4,51	2,82											
Assets	of	disposal	groups	classifi	ed	as	held	for	sale	12,00	7,00	211,00	105,00
6,29	4,73	2,93											
Total	assets	$	19,45	$	18,64	$	8,51						

Figure 4

To format the data you can create a macro to move numbers into a consistent column and then use a function to sum the text into a single cell. Once you run the function and the macro the format is cleaned up as shown below:

	2008	2007	2006
ASSETS			
Non-current assets			
Property, plant and equipment 9	9,012	10,107	3,655
Intangible assets other than goodwill 10	885	806	37
Goodwill 5	2,387	2,145	112
Investments in joint ventures and associates 11	551	592	1,494
Deferred income tax assets 8	44	22	11
Other non-current assets 13	278	240	272
	13,157	13,912	5,581
Current assets			
Inventories 14	2,416	1,619	864
Trade and other receivables 15	1,369	1,802	556
Prepayments	76	196	82
Loans receivable	108	48	19
Receivables from related parties 16	137	60	54
Income tax receivable	262	86	51
Other taxes recoverable 17	397	351	331
Short-term investments 18	589	25	25
Cash and cash equivalents 19	930	327	842
	6,284	4,514	2,824
Assets of disposal groups classifi ed as held for sale 12	7	211	105
	6,291	4,725	2,929
Total assets	19,448	18,637	8,51

Figure 5

Writing the macro and the function only require a few lines of code using two fundamental concepts. The first is a FOR and NEXT loop and the second is the CELLS command. In the next few chapters these concepts are described in detail and an explanation of the code is included appendix to this chapter.

Structure of a Project Finance Model that Accounts for Different Financing, Risks and Accounting in Different Phases over the Life of a Project

Whereas you can think of corporate finance and corporate models as computing the value of a family, you can think of project finance models as representing the value of one person from time the person is conceived until he or she dies. Unlike corporate finance analysis there is no history in project finance analysis as the model stats before the person is born. Instead, the project finance models evaluate risks and returns for different phases in the defined lifetime of a project. The source of data is some kind of contract, consulting report or engineering analysis rather than financial statements. As with a person,

risks and value change over the course of a life and eventually the project becomes worthless near the end. There is no historical record for a project finance entity known as a special purpose vehicle (SPV) and therefore the launching point for projection of financial statements is construction of a sources and uses of funds during the construction phase of a project rather than a historic balance sheet.

Key financial outputs from project finance model come directly from the cash flow statement rather than the profit and loss statement. The single statistic that has the most importance for project owners is the equity IRR that measures the growth rate in case flows after money has been paid to lenders (debt service). The equity IRR is highly influenced by the amount of debt financing, the method and timing of the debt repayment and the tenor of the debt. Equity IRR also depends on whether and when the project is sold as well as whether and when the debt is re-financed. As the financing structure has such a large effect on the economics of projects, evaluating a project from the perspective of lenders is an essential part of the modelling. From the lender perspective, the buffer of cash flow relative to debt service (what percentage is the cash flow above the debt service) that is measured by the debt service coverage ratio and is very often a key component of the model.

An example of outputs from a project finance model is shown in the diagram below which includes a picture of the project during the construction phase (before the person is born) as shown by the sources and funds analysis. After the commercial operation the picture of the project can be summarised by the cash flow relative to the debt service..

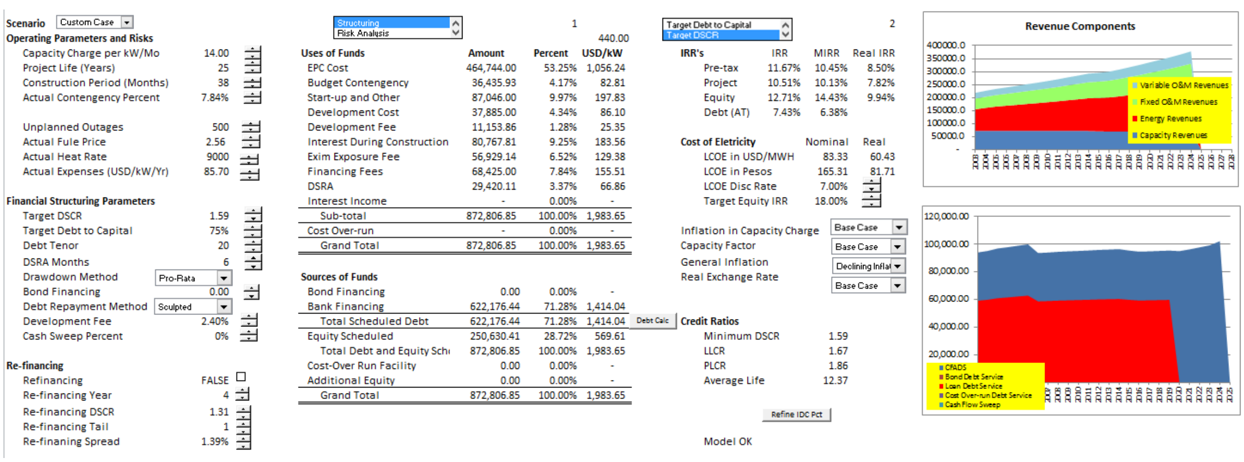


Figure 6

Project finance models typically have two distinct objectives. The first is to structure the debt and equity that will be issued in the transaction including the size of the debt, the tenor of the debt and the manner in which debt will be repaid. The second is to assess specific risks in different time periods of the project life given the defined financial structure. The project finance models should be also be able to assess the effects of different types of re-financing and compute the value of the project over time as the risks change.

The general structure of a project finance model is illustrated on the diagram below. One of the essential elements of a project finance model is that different calculations are made for distinct phases of the project – the development phase, the construction phase, the operation phase, the debt repayment phase and possibly a re-financing phase. The sources and uses statement is computed during the development and the construction phase but not for other phases of the project. While the things that go into this part of the model are not complicated to think about – what ones spends money on and how one raises the money – the source and use statement provides a good summary picture of what the project is about. From a mechanical perspective, the sources and uses statement replaces the balance sheet as the starting point for the balance sheet accounts. This is illustrated in the diagram below where arrows from the source and use statement launch the fixed asset schedule and the debt schedule. The working

module that computes revenues and expenses is similar to the corporate model as is the fixed asset schedule and the debt schedule. Part of the debt schedule is computing the interest during construction that is capitalized to the cost of the plant.

A project finance model can involve complex programming issues regarding (1) setting-up time periods; (2) working out a funding cascade during construction for senior debt, subordinated debt, and equity during construction; (3) modelling the debt service reserve account and the maintenance reserve account; (4) developing a cash flow waterfall that works through cash flow priorities; (5) sculpting debt repayments to meet a debt service coverage constraint, modelling depreciation that depends on calendar years; and, (6) re-financing debt and incorporating cash sweep covenants. The difficult challenge in creating a project finance model is to address these issues without making the model hopelessly complex and cumbersome with many macros and complicated formulas. Part 4 addresses programming issues to resolve these issues in a painless manner as possible.

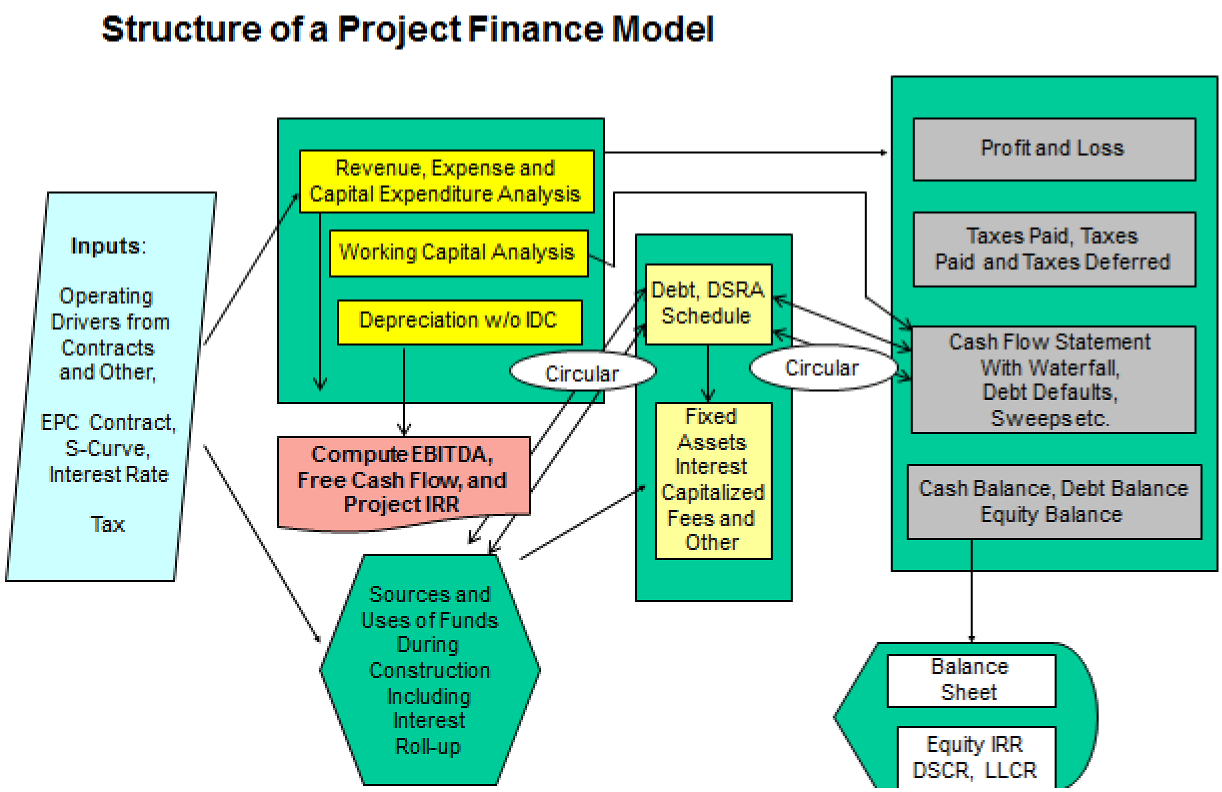


Figure 7

Since a project is generally a one-off investment where debt and equity investors focus on cash flow rather than accounting earnings, the structure for computing cash flow is also different in a project finance model then in a standard corporate model. For a project finance model, the final part of the cash flow waterfall is the dividends paid to the owners of the SPV (sponsors) meaning that dividends are not defined by a dividend payout, dividend per share or some other algorithm, but rather are the residual cash flow not paid or reserved elsewhere. Effective modelling of cash flows involves integration of the debt schedule with the cash flow waterfall in the cash flow analysis as well as launching the model from a sources and uses of funds analysis. Risk analysis of a project finance model is also different for different phases as the construction period typically involves technical risks and the operation period includes economic risks. Finally, as with the corporate model, the balance sheet is part of the output in which all of the accounts such as plant balance, debt service reserves, senior debt balance, subordinated debt balance and common equity balance are already defined.

Reconciliation of IRR in Project Finance with ROI in Corporate Finance

The return on investment is an important number in corporate finance but it all but irrelevant in project finance. However, over the life of a project the time, investment and cost of money weighted return on investment is the same as the IRR. The equivalence of the IRR and the ROI are illustrated along with a few more excel ideas on the excerpt below. A very simple project finance model with no taxes, no debt and a one year construction period is illustrated. Earnings are computed after depreciation expense on the construction expenditure and because the net investment declines the return on investment increases from 3.2% to 117%. The IRR on the investment is somewhere between the low value and the high value. The IRR can be computed by typing the IRR function and then shading the entire row as long as no numbers other than the cash flow are in the row (to shade an entire row you can press SHIFT and then the SPACE BAR key.)

To reconcile the IRR and the ROI, you can compute a series of weights and then use the SUMPRODUCT function to compute the weighted average. In computing weights, the notion of using a SUM on the entire row is illustrated in the excerpt. The last equation on the diagram shows the you can also use multiple rows when making calculations with the SUMPRODUCT function.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
23				IRR and ROI Reconciliation										
24														
25			0	1	2	3	4	5	6	7				
26		Construction Phase	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE				
27		Operation Phase	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE				
28														
29		EBITDA		70.00	77.00	84.70	93.17	102.49	112.74	124.01				
30		Construction Cost	400											
31		Depreciation		57.14	57.14	57.14	57.14	57.14	57.14	57.14				
32		Earnings		12.86	19.86	27.56	36.03	45.34	55.59	66.87		<---- =J28-J30		
33														
34		Net Plant	400.00	342.86	285.71	228.57	171.43	114.29	57.14	0.00		<---- =I33-J30		
35		Equity	400.00	342.86	285.71	228.57	171.43	114.29	57.14	0.00		<---- =J33		
36														
37		Return on Investment		3.2%	5.8%	9.6%	15.8%	26.5%	48.6%	117.0%		<---- =J32/I35		
38														
39		Cash Flow	-400.00	70.00	77.00	84.70	93.17	102.49	112.74	124.01				
40		IRR	13.042%		<---- =IRR(C38:J38)									
41														
42		Reconciliation demonstrating that IRR is a time, investment and cost of capital weighted average												
43														
44		***Investment Weighting***		25.0%	21.4%	17.9%	14.3%	10.7%	7.1%	3.6%		<---- =I33/SUM(33:33)		
45		Discount Factor		88.5%	78.3%	69.2%	61.2%	54.2%	47.9%	42.4%		<---- =1/(1+$C$38)^J24		
46		***Discount Factor Weighting***		20.0%	17.7%	15.7%	13.9%	12.3%	10.9%	9.6%		<---- =J46/SUM(46:46)		
47		Investment x Discount Factor		5.01%	5.01%	5.01%	5.01%	5.01%	5.01%	5.01%		<---- =PRODUCT(J47,J45)		
48		***Combined Weighting***		***31.3%***	***23.7%***	***17.5%***	***12.4%***	***8.2%***	***4.8%***	***2.1%***		<---- =J48/SUM(48:48)		
49														
50		***Weighted ROI***	***13.042%***		<---- =SUMPRODUCT(49:49,36:36)									
51														

Figure 8

Structure of an Acquisition Model that Reflects Alternative Transaction Prices and Debt Terms and Evaluates the Return and Risk to Different Providers of Capital

If a project finance model is analogous to simulating your life and a corporate finance model is like representing your family, an acquisition model could be thought of as modelling a dramatic change in the structure of a family -- perhaps moving to a different country, changing religion or borrowing a lot of money for education -- that changes the outlook for the family. To make a model of the future prospects of the family after such an event, you could start with the history of the family as with the corporate model. But then you probably want to adjust the model to reflect to changes that occur because of the new event. Making an acquisition model is something like this. These models may be developed to determine how much to pay for a target company and how much of the purchase price can be financed with different types of financing including amortizing debt, debt with a bullet maturity and debt with capitalizing interest

(this is sometime known as “ABC.”) Key assumptions in an acquisition model include how much the operating cash flow can grow with new owners and a new strategy as well as the how much the company can be sold for after the holding period. Financial ratios used in assessing an acquisition are often related to the EBITDA. These include the enterprise value (net debt plus equity value) to the EBITDA; the senior debt level to the EBITDA; and the total debt level to the EBITDA. As with a project finance model, an acquisition model can be used for both structuring the amounts of different type of debt as well as risk assessment.

The figure below illustrates output from an acquisition model that try to paint a picture of the transaction as well as the costs and benefits that arise. Graphs on the right show which capital provider receives the cash in what order and the break-even level of EBITDA for the various different sources of capital. Data on the left shows how much was paid for the company and where the money comes from. The IRR is computed for each of the sources of capital.

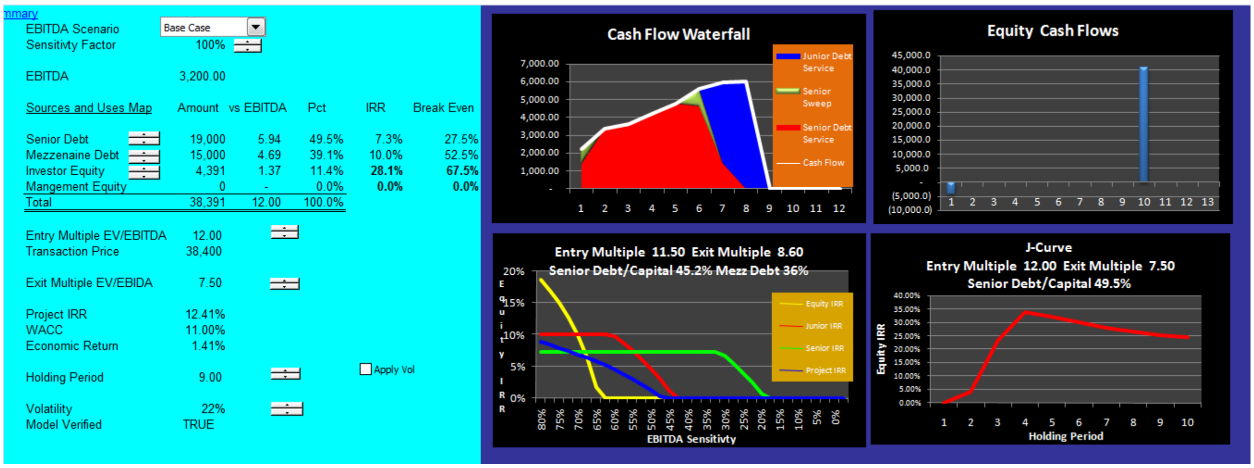


Figure 9

The structure of an acquisition model is illustrated in the diagram below. The diagram demonstrates that modelling an acquisition transaction involves combining some aspects of corporate models and other aspects of project finance models. As with a corporate model, the history of the company is a starting point for painting a picture of the company. However, as with a project finance model, equations in an acquisition model should begin with a sources and uses analysis that shows how much cash is used for the transaction and where the cash comes from. After the sources and uses map is established, a goodwill analysis should be added that allows construction of a pro-forma balance sheet. Like in a project finance model, analysing the cash flow priorities is central to the process.

The general structure of computing a pro-forma balance sheet through mapping the sources and uses of funds along with a goodwill analysis that incorporates the accounting aspects of the transaction is shown in the second column of the diagram. Once the pro-forma balance sheet is created, the modelling process contains similarities to both a corporate model and a project finance model. As with a corporate model that works through different asset and liability accounts on the balance sheet, an acquisition model works through accounts where the first year closing balance comes from the pro-forma balance sheet. As with a project finance model, defining phases in an acquisition model is an important part of the process – the transaction period should be distinguished from the holding period and the terminal period. The right hand side of the diagram below shows that the cash flow modelling process is analogous to the methods described for a project finance model where a waterfall progression measures the priority of cash flows to the various sources of funds and ultimately the equity holders.

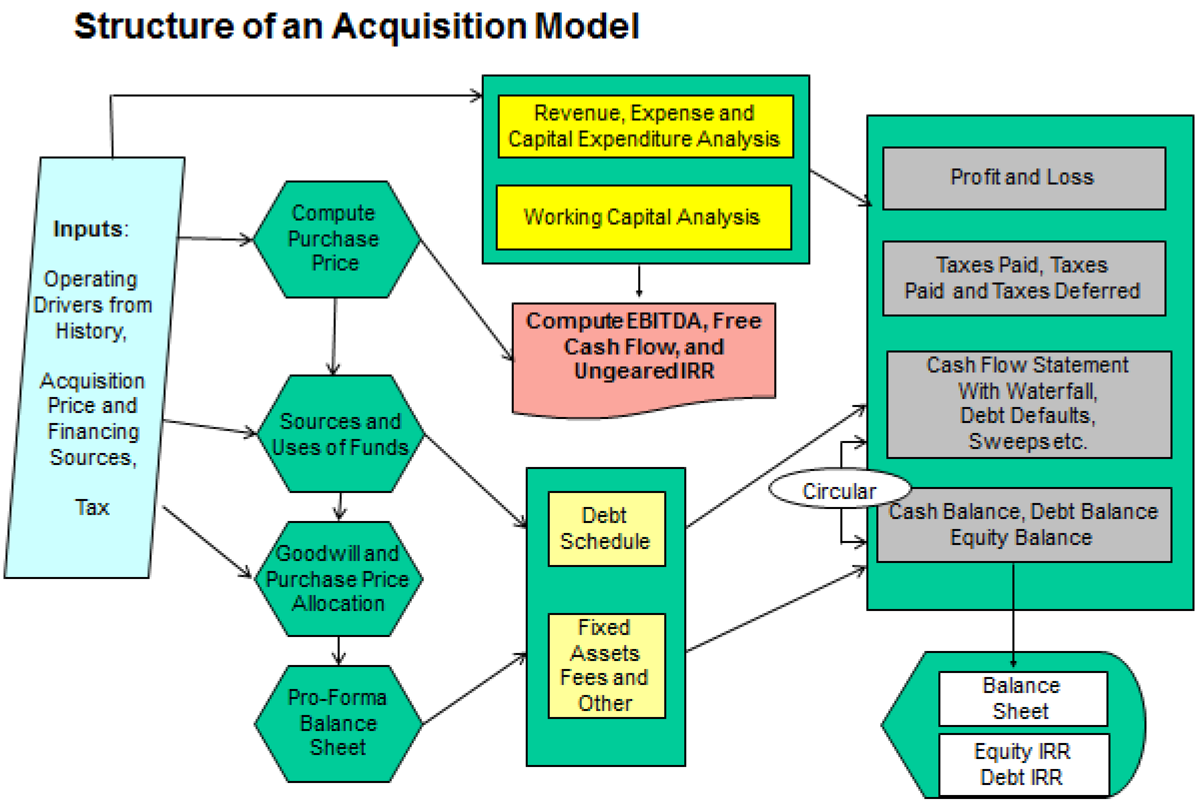


Figure 10

Some of the challenges in creating models that measure the value of an acquisition or a leveraged buyout include:

- Creating a cash flow waterfall with alternative amortizing, bullet and capitalizing debt as well as cash requirements and revolving debt facilities;

- Developing a alterative structuring assumptions and a pro-forma balance sheet;

- Structuring the cash flow analysis to determine the points at which alternative financing instruments yield returns below the risk free rate;

- Simulating alternative purchase prices to yield required returns with different holding periods, exit multiples and holding periods;

- Modelling income taxes and alternative tax treatments of transactions; and,

- Simulating the structure of equity cash flows to alternative investors from earn out provisions and equity kickers.

Structure of an Integrated Merger Model that Produces Forecasts of Earnings Per Share Given Different Transaction Structures and Synergy Estimates

The objective of a merger integration model is to evaluate how much to pay for a company and how to structure the financing of a merger transaction. This kind of model is like a royal marriage in the 16th century where the merger of two families was supposed to make the combined new family better than the

sum of the individual families. An integrated merger model typically compares earnings per share and credit statistics in the case where a merger takes place to a scenario without a merger. The prospective earnings of the merged company depend on how much is paid for the acquisition and how many synergies are generated from changing management as well as the financing of the transaction. When measuring the cost and benefits of a merger using an integrated model, the information base is the historic operations, projected cost savings and/or revenue increases as well as the transaction terms.

The diagram below demonstrates that an integrated model structure mixes elements of an acquisition model and a standard corporate model. As with acquisition models, the starting point of a merger integration model is a source and use analysis of the transaction and the pro-forma balance sheet after goodwill and other adjustments. The only difference between the acquisition model and the integrated model is that the pro-forma balance sheet begins with existing balance sheets of both the target company and the acquiring company. For an integration model, the transaction assumptions incorporated in the sources and uses analysis may include a share exchange, multiple debt issues and new equity offerings.

Once the starting balance sheet established, the remaining calculations and the cash flow process are similar to the corporate model where computation of net cash flow leads to the accumulation of a net cash balance and the net cash balance is separated between short-term debt and surplus cash liquid investments. In a integrated model the debt schedule includes issues retired in the transaction (shown in the sources and uses analysis) as well as new debt financing to pay for the merger as well as the associated fees and breakage costs. Shares issued in the transaction could come from a new share issuance or from the shares issued to target company shareholders as part of a share exchange transaction. The diagram below shows that instead of computing a working analysis to derive revenues, expenses and capital expenditures these numbers come from individual corporate models for the target company and the acquiring company. The most difficult item to forecast is often the synergies that arise from changes in management strategy that come about from the transaction. In practice, these synergy projections must be made with only public information and little time when using a model to construct an offer for a company.

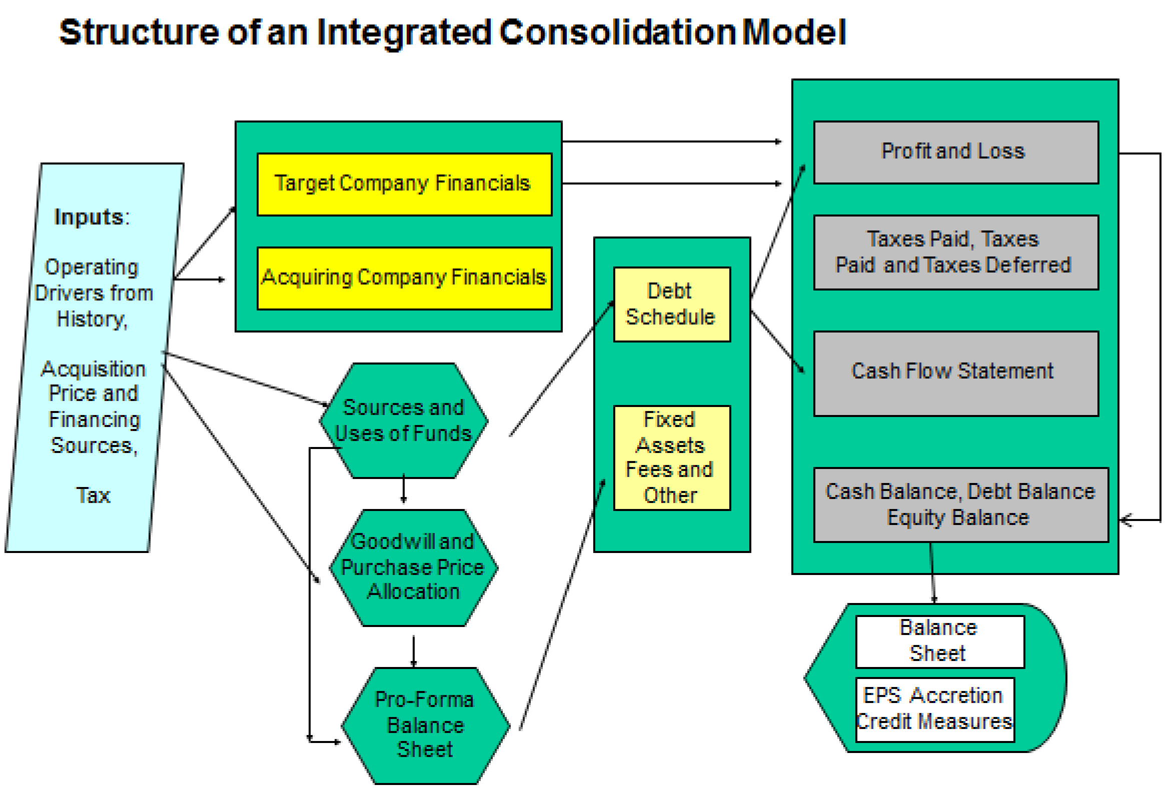


Figure 11

A comparison of the elements that are included in the layout of different types of financial models is shown in the table below.

	Project Finance	Corporate Model	LBO Model	M&A Integration Model
Information Base	Contracts and analysis of Commodity Prices and other value drivers	Historical financial statements; Analysis of value drivers	Historical financial statements; Analysis of value drivers; Transaciton Terms	Historical financial statements; Analysis of value drivers; Transaciton Terms
Model Starting Point	Sources and Uses Analysis	Historic Balance Sheet	Sources and Uses and Pro-Forma Balance Sheet	Sources and Uses and Pro-Forma Balance Sheet
Cash Flow Process	Cash flow waterfall that ultimately measures dividends paid to equity	Net cash flow after dividends that result in changes in short-term debt or surplus cash	Cash flow waterfall that ends in dividends paid to equity	Cash flow changes that result in changes in short-term debt or surplus cash
Debt Analysis	New Debt Issues from Transaction	New and Existing	New Debt Issues from Transaction	Existing Debt Issues; Retired Debt Issues; New Debt Issues
Model Termination	End of project life	Arbitrary terminal period	Transaction holding period	EPS analysis period
Model Complexities	NOL; cash traps and sweeps; construction period issues; debt service reserves; debt sculpting	NOL; target capital structures; circularity; depreication vintage	NOL; cash sweeps; interest capitalization on sub debt; debt service reserves; terminal period	Pro-forma balance sheet; minority interest changes; new debt issues
Model Output	Equity IRR; Project IRR; DSCR	DCF Valuation; EPS projection; Implied P/E; Credit Quality	Equity and Debt IRRs; Debt/EBITDA	Project EPS and Other Ratios on Standalone vs Combined Basis

Figure 12

Subsequent sections of this chapter discuss issues in creating each of the major model components. In addition to the general description of what should be included in each section, a discussion of some practical programming tips for those who are involved in construction of models on a regular basis.

Chapter 5: Avoiding Bad Programming Practices and Creating Effective Auditing Processes for Model Verification without Following Unnecessary and Bureaucratic Best Practise Rules

For purposes of valuation and investment analysis, financial models do not have to be overly complex with thirty different spreadsheets and tedious detail for items that are relatively insignificant. Most people's reaction to receiving a model with many different sheets and excruciating detail of operating expenses is to put the model in a folder and to not perform risk analysis with the model. Even if valuation models are relatively simple, creating a model that is flexible enough to handle different risks; that accurately measures cash flows; that present the key value drivers and important outputs in an easily understandable and transparent manner; and that does not crash excel because of circular references often requires a disciplined approach to excel programming. A well structured model can avoid the

ghastly feeling of -- after completing a model -- being asked by your boss to open and revise a model that was created a few weeks earlier. This horrible feeling often comes from knowing that you will have to review a long and complex formula with multiple “IF” statements that can no longer be interpreted. These types of formulas are generally incomprehensible without completely re-constructing the formula and splitting it up into many different rows.

To address issues like this, some companies require mandate the use of a set of “best practices” for analysts who program models. While these practices may help in making models transparent and effective in presenting valuation issues, you can become obsessed with the programming practices and lose sight of the ultimate objective of a model. For example, in order to keep formulas the same across excel columns for the transaction period and subsequent periods in an acquisition model, complicated IF statements may be developed that are very difficult to interpret. For almost every task in a spreadsheet model there are many different ways to accomplish your objective. Some like range names, others hate them; some like drop down boxes, others don't; some use SUMPRODUCT and some accomplish the same thing with SUMIF. It is best to keep an open mind about different programming issues and generally also best to try to be as lazy as possible with excel functions. It is also best to not become too bureaucratic about best practices.

Instead of suggesting there is such a thing as best practice, it is easier to make a list of bad practices that should avoided. Through avoiding the bad practices listed below, a model should be easier to interpret and modify:

- There should be no inputs in any part of the model other than the input(s) page. One of the worst and most obvious problems is to include inputs as part of a formula (e.g.A11*5); these partial inputs are difficult to find and make the models inflexible.

- Keep formulas in the model as simple as possible and clearly delineate how each formula is derived from the inputs (this is often a problem with long “if” statements). Long formulas can be avoided by splitting formulas into multiple different rows and by using TRUE/FALSE switches. Do not use nested IF statements. Ever. This does not mean that you should follow the silly rule of thumb were formulas are not longer than your thumb (unless you have a very long thumb). But overly complicated formulas are the worst practice of all.

- Make sure that spreadsheet columns are consistent throughout the model and that the formulas for each column are identical (with the possible exception of the very first period in corporate models and acquisition models.)

- Include the units (such as tons or thousands of Euros) for each column of the inputs and the working sheet.

- Carefully specify the time period of the model using time period codes that define alternative phases of the analysis. Use the LOOKUP or MATCH and INDEX functions rather than the VLOOKUP or HLOOKUP function to associate inputs with the time period so users can add rows or columns to the model without worrying about different results. Put the timeline at the top of each sheet.

- Divide the model into separate modules, beginning with input modules and make the inputs a separate colour (the word module simply refers to a separate part of the model -- it could be a separate spreadsheet page or simply a segment of one sheet.) When entering inputs in one or more modules, operating inputs should be separated from financial inputs.

- Work through every single balance sheet item showing the opening balance, additions and subtractions from the account and the closing balance for each the accounts. This analysis should be made for everything single title in the balance sheet ranging from cash accounts to common equity.

* Limit or avoid the use of macros and iterations to resolve circular references as circular references are not present in the real world and fixing circularity makes many risk analysis programming techniques more difficult.

* Use the balance sheet and other items as auditing tools and include a separate "integrity" page of the model to present verification checks. The verification should point to the location of the model errors so you do not have to look around the model to find problems. Include a "dashboard" at the top of each page of the model to monitor the integrity and key outputs of the model.

* Assure that no formulas in the output part of a model affect anything in any other section of the model. This means that you should be able to delete the output section without causing any reference errors in the mechanical calculation parts of the model.

* Test various balances such as the debt balance, the net asset balance, the reserve balance and other items relative to the opening balance using the MIN function instead of IF statements. The MIN function together with the opening balance puts a cap on things that can lead to negative balances. For example, the scheduled debt repayment can be capped at the opening balance – you do not want to pay more than the existing balance back to the bank.

The above principals seem obvious when written down in a book. However, in the midst of creating a model to meet a deadline, it is very easy to ignore these principals as they seem to slow you down when working under a tight deadline. Examples of bad practices include entering input data in the fifth sheet of a model; including complicated revenue and expense calculations with long if statements directly in the income statement; forcing the balance sheet to balance using some kind of a cash balancing item; computing interest expense without separately listing debt issues and not being consistent with time periods.

The single worst practice that is often made by otherwise very good modellers is to make formulas that are far too long. An example of a formula (for projected prices) that is not transparent and almost impossible to verify (taken from an actual model) is shown below:

```
=IF(AB5<14,IF(AB2=6,AA39*(1+inflation),AA39),IF(AB5=14,'OperatingInputs'!$E$103/'OperatingInputs'!$
E$104,IF(LEN(AB5)=2,AA39,AA39*(1+inflation))))
```

This formula, contains a number of bad practices. One problem is that fixed numbers are included in the formula (i.e. the number 14 and the number 6.) The larger problem is that the formula is far to complex to easily verify and audit. This formula could be vastly improved if one would split it up into a number of separate rows where one would show the inflation rate in a separate row, the tests in separate rows and the alternative results of different conditions in various rows. If you would be asked to review somebody else's model, it is a good idea to split up formulas like this one. This formula took about fifteen rows and once the more transparent separate rows were presented, several obvious errors were apparent.

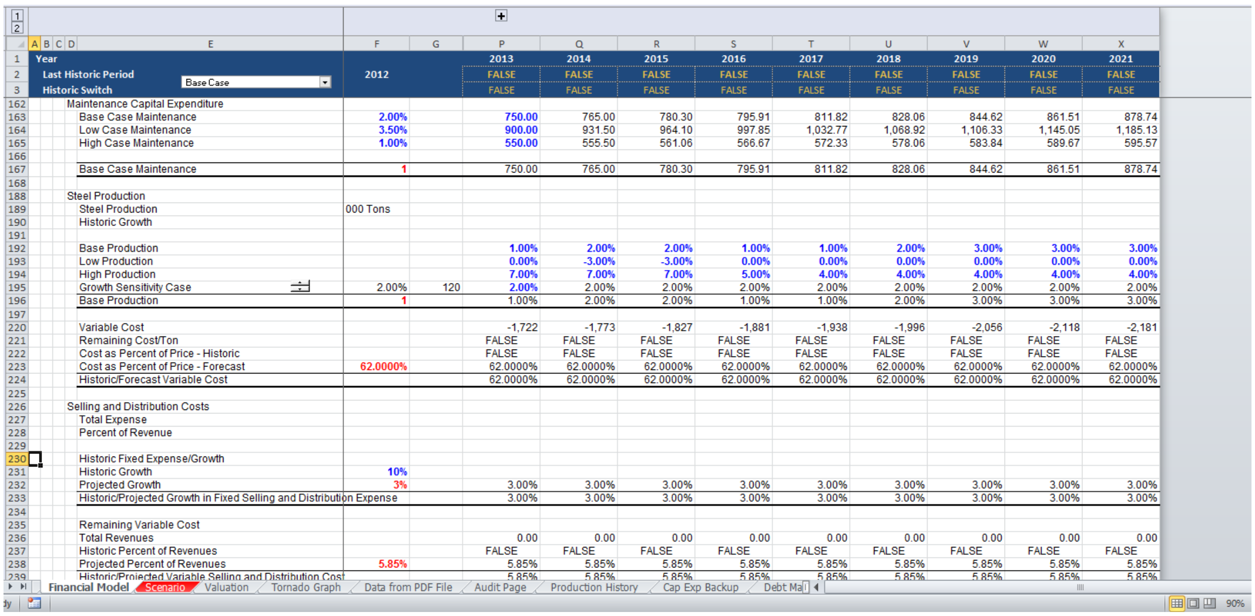
How to Make Financial Modelling More Efficient and Accurate

The paragraphs below highlight a few programming techniques that implement some of the concepts listed above so that your model does not become a complete mess. If you are more interested in general modelling concepts rather than the implementation details or you want to be able to read models but not to program them, you should skip the detailed discussion of practical programming and begin reading the next section on time periods and valuation.

Creating Short-cut keys and Setting-up the Model Area so you can build your Model Really Fast

This seems like a trivial little detail, but in structuring a model you can make it much easier to read – the transparency objective – by doing a few things before you start typing a single number in the sheet. Models generally are presented in a similar manner to financial statements from annual reports where

time (years, quarters or months) is shown across columns and items such as revenues listed on different rows. In setting up the columns, it is nice to include some thin columns at the beginning of the sheet so that you can press the CNTL, UP and the CNTL, DOWN keys and move from section to section. The time line section will often be the first section followed by the assumptions section, the operations section and the depreciation section. By putting headings in the first column (e.g. the word timeline, assumptions, operations etc.), you can move from section to section. In most type of models it is also good to leave a few blank columns between the titles and the model equations. In these columns after the account names you can list the inputs, transfer inputs that drive the equations and you can incorporate checks of various items. This is part of the process of being transparent where a reader can hopefully visualise how the equations are working as shown in the example below.



	E	F	G	P	Q	R	S	T	U	V	W	X
1	Year			2013	2014	2015	2016	2017	2018	2019	2020	2021
2	Last Historic Period (Base Case)	2012		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
3	Historic Switch			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
162	Maintenance Capital Expenditure											
163	Base Case Maintenance	2.00%		750.00	765.00	780.30	795.91	811.82	828.06	844.62	861.51	878.74
164	Low Case Maintenance	3.50%		900.00	931.50	964.10	997.85	1,032.77	1,068.92	1,106.33	1,145.05	1,185.13
165	High Case Maintenance	1.00%		550.00	555.50	561.06	566.67	572.33	578.06	583.84	589.67	595.57
166												
167	Base Case Maintenance	1		750.00	765.00	780.30	795.91	811.82	828.06	844.62	861.51	878.74
168												
188	Steel Production											
189	Steel Production	000 Tons										
190	Historic Growth											
191												
192	Base Production			1.00%	2.00%	2.00%	1.00%	1.00%	2.00%	3.00%	3.00%	3.00%
193	Low Production			0.00%	-3.00%	-3.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
194	High Production			7.00%	7.00%	7.00%	5.00%	4.00%	4.00%	4.00%	4.00%	4.00%
195	Growth Sensitivity Case	2.00%	120	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
196	Base Production	1		1.00%	2.00%	2.00%	1.00%	1.00%	2.00%	3.00%	3.00%	3.00%
197												
220	Variable Cost			-1,722	-1,773	-1,827	-1,881	-1,938	-1,996	-2,056	-2,118	-2,181
221	Remaining Cost/Ton			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
222	Cost as Percent of Price - Historic			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
223	Cost as Percent of Price - Forecast	62.0000%		62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%
224	Historic/Forecast Variable Cost			62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%	62.0000%
225												
226	Selling and Distribution Costs											
227	Total Expense											
228	Percent of Revenue											
229												
230	Historic Fixed Expense/Growth											
231	Historic Growth	10%										
232	Projected Growth	3%		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
233	Historic/Projected Growth in Fixed Selling and Distribution Expense			3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
234												
235	Remaining Variable Cost											
236	Total Revenues			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
237	Historic Percent of Revenues			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
238	Projected Percent of Revenues	5.85%		5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%
239	Historic/Projected Variable Selling and Distribution Cost			5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%	5.85%

Figure 13

Using short-cuts rather than using the mouse will enable you to work faster you more easily develop and modify the model. (In some financial modelling courses imposed on young bankers, the mouse is removed from computers so students learn how to navigate around spreadsheets much more quickly, lest they waste a minute in creating collateralized debt securities out of sub-prime loans.) Use of short-cut keys may seem a bit odd when you first use them instead of the mouse, but if you practice, they really can make your work on the model easier. One of the most helpful shortcuts is the combination of the following two keystrokes that allows you to very quickly copy and paste rows in a financial model:

1. Press the SHIFT,CNTL, → (right arrow) at the same time to mark a row, and
2. Press CNTL,R to copy the formula or data to the right.

The problem with this short cut is that it copies the contents of the first cell to each column of the sheet, all the way to the right end of the sheet. To limit the copying of columns to the maximum rows of your sheet – the maximum number of periods that you may forecast, you can hide the columns for which you do not want the item to be copied. To hide columns to the right of the model periods, you can group all of the columns to the right of the last column in your program. To use this method, use the SHIFT,ALT,→ combination to group columns and press the number one on the top left corner of the spreadsheet as summarized below:

1. Shade the entire column of the first column to be hidden (you can used the CNTL, SPACEBAR combination)

2. Press the SHIFT, CNTL, → to shade the remaining columns in the sheet
3. Use the SHIFT, ALT, → combination to group the remaining the selected columns.
4. Press the Number 1 in the square box at the top left of the sheet.

If you need the columns to the right, you can press the number two button instead of the number one key. Results of the grouping approach are shown on the diagram in the next section where the right part of the sheet after the columns have been grouped is grey.

Short-cuts are pretty cool, but it is even more useful to make your own short-cuts. When making your own short-cut keys you can simply create a macro around the thing you want to repeat. When making a macro, you put in a short-cut key as illustrated in the next section, but if you select to make the macro run with CNTL and c, then the copy function will no longer work. Instead, you can create the macro with CNTL and capital C so that it works with SHIFT, CNTL, C. When creating your own short-cut to do something like formatting cells with two decimal places (unlike the SHIFT, CNTL, 5 key which does not include decimals) you can do the following:

Step 1: Go to the cell that you will format with a percent sign and two decimals. You must be on the cell because you should not move the cell as part of the macro process.

Step 2: Record a macro and define a short-cut key with the SHIFT keyboard key. For example, press the capital D for decimals. Do not move the cursor after you begin recording the macro.

Step 3: Change the formatting in the cell (you could use the CNTL and 1 short-cut).

Step 4: Stop recording the macro without moving the cursor.

A short-cut key that avoids the irritating excel feature that automatically switches inputs to percentages can be made with the simple macro shown below.

```
Sub fix_decimal()


 ActiveCell = ActiveCell * 100
 Selection.NumberFormat = "#,##0.00"


End Sub
```

Figure 14

Colour Conventions and Creating the SHIFT, CNTL C Macro to Colour Inputs

In a well structured financial model, colours should be used as a guide to what is happening in various cells of the model. This means the colours should not be used to make the model into an attractive piece of art, but it is better that they provide readers of the model with a quick understanding of where the numbers in a cell come from. One principle is that input cells should be collared differently from other cells, generally through using the fill colour and the background colour. There are few methods to colour inputs. A simple method is to use the F5 key and then the press the special key. Then select the Constants option and find all of the inputs. After finding the inputs, simply select the selected foreground colour.

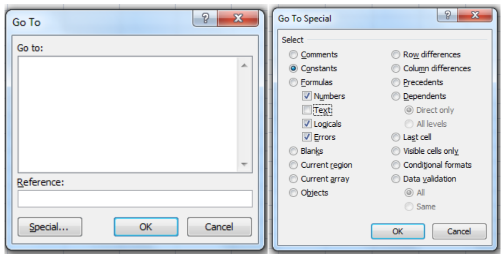


Figure 15

When using the F5 and the paste special, you can create the process in a macro and redo the process every time that you make a change. When creating the macro you can assign the macro to a CNTL key and use then have your own short-cut key such as SHIFT, CNTL, C to re-do the colours at any time. You can create similar short-cut keys to format your spreadsheet. For example, if you want to format a percentage you can press CNTL,% (SHIFT, CNTL, 5), However this short-cut key does not present decimals. If you want to show decimals, go to a cell that you want to format (this is important) and then start recording a macro. When creating the macro, press the SHIFT B or some other letter and change the number of decimals. Then simply stop recording the macro. The picture below shows how to begin recording the macro.

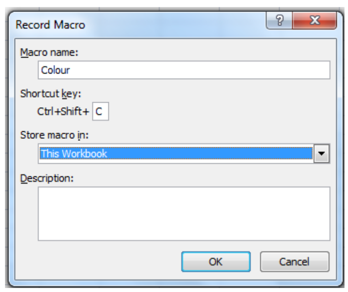


Figure 16

A second principle is that a different font colour should be used for cells in which data comes from another sheet. For example, if price data is transferred from the input sheet to the workings sheet, that cell should have a colour to notify users in what sheet they can quickly find the source of the data. A macro that sets the font colour of a cell from the tab colour of the sheet included with the materials. Other colours can be used for cells that have been computed from the goal seek or the solver and for cells that are computed through the operation of a macro. Finally, cells in which calculations are made from information in the same sheet should not have a font or a fill colour.

The excerpt at the beginning of this section illustrates a few of the set-up ideas discussed above. The sheet (from an integrated consolidation model) is set-up using the SHIFT, ALT, → method to limit the size of the sheet with the grouping method (when you press 1 at the top left, the columns are hidden, while when the number 2 is pressed, the columns are unhidden.) The red cells come from the target company financials which has a red tab colour while the blue cells come from the acquirer sheet that has a blue tab colour. Finally, the example illustrates that it is a good idea to make a few small columns on the left of the spreadsheet so that it is clear what rows are sub-totals and headings.

Useful Functions in Setting-up a Sheet

In setting-up a sheet for a financial model it is often useful to make a couple of user-defined functions in addition to your customised short-cut keys. Creating your own function has some important contrasts to

making a macro. In the excel workbook, your function works like the any other function such as the SUM function where you use an equal sign and put something inside the parenthesis. When creating a function rather than a standard macro in excel, there are a couple of basic concepts:

1. The name of the function must be defined as a variable somewhere in the code.
2. Any value that is used from the excel sheet must be read into the function (you cannot use something like RANGE("A1") in the function.

One function that is useful is to show formulas in the sheet adjacent the cell where the calculation is made (this function was used in some of the excerpts above). To create such a function, you should go to the visual basic (you can press ALT and F11). Then you can type in a function as illustrated below. A simple version of the function names show_form and a little fancier version named show_formula is illustrated below. Note that you must start the code with the name FUNCTION rather than SUB.

```
Function show_form(cell)
show_form = cell.Formula
End Function
```

Figure 17

```
Function show_formula(cell)
show_formula = "< ---- Formula for: " & cell.Address & "  " & cell.Formula
End Function
```

Figure 18

It is also useful when setting up a sheet to create a function for showing the sheet name as a formula in the excel sheet. This function requires only one line of code as demonstrated below.

```
Function name_sheet(cell)

name_sheet = cell.Parent.Name

End Function
```

Figure 19

After entering this function, you can type =name_sheet(cell) in any cell and refer to the current sheet or another sheet and find the sheet name.

Creating a Model Integrity Page and Use of TRUE and FALSE Switches and so that Excel Tells you Where your Problems are and you do not have to Continually Check Various Different Sheets in Your Model

Part of an efficient model design is creating a method where the program itself reports things that do not work. It is best to come up with a message somewhere at the top of each sheet that documents the location of problems with the model so you do not have to continually look around the workbook to find the problem. A useful technique is placing a “dashboard” on each page of the model that shows key outputs, inputs and sensitivity analysis switches. In addition, the dashboard on each page should show an overall check on the integrity of the model – does the balance sheet balance, is the debt balance positive, are the dividends non-negative, do the sources of cash equal the uses of cash and so forth. Sometimes it is useful to include a series of audit checks as to whether debt is in default as well as mechanical checks.

An effective way to set up the integrity check of a model is to use TRUE and FALSE logical variables created in excel in various different ways. The use of TRUE and FALSE switches is helpful in many different parts of the model. Use of TRUE/FALSE variables eliminates the need for painful nested IF

statements that can be very difficult to audit and the variables are almost essential in structuring the time line of a model. A TRUE/FALSE variable can be created by simply using and equal sign (for example, =1=1 is TRUE). It is often useful to apply the AND function together with a series of logical variables to test if the overall value is TRUE (for example AND(1=1,2=2) is TRUE.) Further, when IF statements are used, they can be used with the TRUE/FALSE in the logical section of the statement. The following step by step process illustrates how to create a verification page with TRUE/FALSE switch variables:

Step 1: After computing the balance sheet, subtract the total assets from liabilities on a separate line. Create similar calculations for the debt balance, the sources and uses of funds and other items. Creating a good test can be a creative process.

Step 2: In a separate row, use a TRUE/FALSE logical variable (created by setting one cell equal to another) to test whether the difference, after rounding, is equal to zero. (The rounding is often necessary because the difference is not precisely equal to zero if, for example, there is a division by three somewhere in the model).The formula is

=ROUND(difference,3) = 0.

Step 3: Once the TRUE/FALSE result is established for each period, the AND function can be used to test whether the balance sheet balances in every single one of the periods. The AND function is used on a range of TRUE/FALSE logical variables and placed to the left or the right of all of the year by year tests as illustrated below.

The figure below illustrates the verification of the balance sheet that feeds into an aggregate balance sheet test. The row labelled "test" uses a switch and the ROUND function to make sure the balance sheet balances in each period. If all of the tests are TRUE, then the aggregate test computed with the AND function is also TRUE. The excerpt shows how a SUMIF function can be use along with a time period switch to limit the test to the historic period. Additionally, the excerpt shows how an entire row can be used with the AND function.

	A B C D E	F	G	H	I	J	K	L	M	N	O
1	Year				2006	2007	2008	2009	2010	2011	2012
2	Last Historic Period Base Case	2012			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE
3	Historic Switch				TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
837	Trade and other receivables 15				610.00	1,862.00	1,506.00	1,108.00	1,293.00	979.00	907.00
838	Prepayments				464.00	633.00	735.00	450.00	599.00	671.00	531.00
839	Cash and cash equivalents 19				993.00	400.00	1,627.00	858.00	854.00	955.00	2,143.00
840	Total Current Assets				2,931.00	4,514.00	6,284.00	4,244.00	4,816.00	4,793.00	5,559.00
841	Assets of disposal groups classified as held for sale 12				105.00	211.00	7.00	7.00	2.00	9.00	930.00
842	Total Current Assets including Assets Disposed				3,036.00	4,725.00	6,291.00	4,251.00	4,818.00	4,802.00	6,489.00
843	Total assets				8,499.00	18,637.00	19,448.00	16,951.00	17,539.00	16,975.00	17,777.00
844											
845	Historic Assets	=I87---->			8,499.00	18,637.00	19,448.00	16,951.00	17,539.00	16,975.00	17,777.00
846	Difference	=I843-I845---->			-	-	-	-	-	-	-
847	Test	=SUMIF(3:3,TRUE,846:846)=0---->		TRUE							
848											
849	EQUITY AND LIABILITIES										
850	Equity attributable to equity holders of the parent entity				4,066.00	5,950.00	4,729.00	5,167.00	5,689.00	5,545.00	5,173.00
851	Non-controlling interests				169.00	406.00	245.00	275.00	247.00	236.00	200.00
852	Total				4,235.00	6,356.00	4,974.00	5,442.00	5,936.00	5,781.00	5,373.00
853	Non-current liabilities										
854	Long-term loans 21				2,649.00	6,825.00	10,041.00	7,998.00	7,868.00	7,245.00	8,169.00
855	Deferred income tax liabilities 8				277.00	1,690.00	1,329.00	1,231.00	1,072.00	1,020.00	927.00
856	Employee benefits 23				117.00	347.00	292.00	307.00	315.00	296.00	294.00
857	Provisions 25				39.00	132.00	153.00	176.00	279.00	285.00	257.00
858	Other long-term liabilities 26				47.00	55.00	58.00	68.00	143.00	285.00	170.00
859	Total Non-Current				3,129.00	9,049.00	11,873.00	9,780.00	9,677.00	9,131.00	9,817.00
860	Current liabilities										
861	Trade and other payables 27				851.00	2,532.00	2,110.00	1,321.00	1,396.00	1,567.00	1,669.00
862	Short-term loans and current portion of long-term loans 21				-	-	-	-	-	-	-
863	Provisions 25				8.00	55.00	63.00	35.00	54.00	53.00	32.00
864	Amounts payable under put options for shares of subsidiaries 4				264.00	606.00	428.00	373.00	476.00	443.00	408.00
865	Liabilities directly associated with disposal groups classified as held for sale				12.00	39.00	-	-	-	-	478.00
866	Total Current Liabilities				1,135.00	3,232.00	2,601.00	1,729.00	1,926.00	2,063.00	2,587.00
867	Total equity and liabilities				8,499.00	18,637.00	19,448.00	16,951.00	17,539.00	16,975.00	17,777.00
868											
869	Difference	=I867-I843---->			-	-	-	-	-	-	-
870	Test	=I869=0---->			TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
871	Aggregate Test	=AND(870:870)---->		TRUE							

Figure 20

Step 4: Link the TRUE/FALSE result from the AND statements and the SUMIF statements and any other test to a separate page of the model that contains other verification checks (for example, in a project finance model or an acquisition model, check whether the sources of funds equal the uses of funds.)

Step 5: Type a title for each test and put the linked TRUE or FALSE next to the test title. Identify the sections of the model that have problems using an if statement that uses the title of the test and the result of the test. The if statement has the form:

IF(test,"",title)

For example, when applying the balance sheet test, the test in the above formula would be the aggregate TRUE/FALSE test from the model. The title would be something like "Balance Sheet Test".

Step 6: Once the sections of the model with problems are identified, make an aggregate presentation of all of the problems in the model. This cell can then be placed in each sheet and each sensitivity analysis to allow you to find problems without looking around the model each time. The aggregate presentation has the form:

=problem1&problem2&…..&problem10

In this equation the problem1, problem2 cells come from step 6 above. The "&" function allows the text to be put together (as if you were adding things.) For better presentation, it is a good idea to put a space before each title so the problems are delineated. You can also create your own function add the text together which is illustrated below. To write your own function simply go to a macro and type the text below existing code.

```
Function add_text(series)

For i = 1 To series.Count
    add_text = add_text & " " & series(i)
Next i

End Function
```

Figure 21

An example of a page that shows verification checks is illustrated in the figure below.

	A	B	C	D	E	F	G
1							
2				**Model Audit Analysis**			
3							
4			**Item Title from Financial Model**	**Test from Financial Model**		**Display if Error**	
5							
6	=Working!C12---->		Development period	TRUE	< ---- =Working!L12		< ---- =IF(D6,"",C6)
7	=Working!C13---->		Financial close date	TRUE	< ---- =Working!L13		< ---- =IF(D7,"",C7)
8			Construction period	TRUE			
9			Commercial Operation Date	TRUE			
10			Month before COD	TRUE			
11			Operation period	TRUE			
12			Sale date	TRUE			
13			Debt Repayment Period	FALSE		Debt Repayment Period	< ---- =IF(D13,"",C13)
14			Debt Retirement Period	TRUE			
15			Re-financing Repayment Period	TRUE			
16							
17			S curve	FALSE		S curve	
18			Level Repayment	TRUE			
19			Annuity Repayment	TRUE			
20							
21			Permanent Debt	TRUE			
22			Re-Financed Debt	TRUE			
23							
24			Balance Sheet	TRUE			
25							
26					=add_text(F6:F24)---->	**Debt Repayment Period & S curve**	
27			**Aggreagate**	FALSE	=IF(D27,"Model ok","Problem: " & F26)---->	Problem: Debt Repayment Period & S curve	
28							
29				=AND(D6:D24)			
30							

Figure 22

Step 7: Place the final aggregate presentation of problems with the model in the dashboard that monitors each page of the model.

Chapter 6: Putting the Most Important Item in a Model – the Assumptions – through Creating Flexible Inputs, Making Effective Analysis of the Top Line, Cash Operating Expenses and Capital Expenditures

In discussing the structure of various models above (using different diagrams for the corporate model, project finance model, acquisition model and integrated model) each financial model had a lot in common. For example, each model began with an input section and model ended with a balance sheet. Each model includes a working section that computes revenues, expenses and capital expenditures; each model type has a debt schedule; each model includes a depreciation section and each model contains an income statement and a cash flow analysis. These components of models that are common to the different models are discussed in the next few chapters. This chapter begins the discussion of common model elements through describing model inputs and the initial section of the model that should compute revenues, operating expenses and capital expenditures.

Concentrating on the True Value Drivers in Financial Analysis; Demand Driven Models versus Supply Driven Models and the Danger of Overcapacity in an Industry

The most important part of the modelling process is to accurately define and analyse input items that drive the value of an investment and effectively present how the risks of the value drivers affect the ultimate value. Value drivers can be economic variables such as industry demand, behaviour of competitors, price, cost of capital expenditures per unit and the fixed and variable cost structure of investments that determine the level of three items that are the key to any model – revenues, operating cost and capital expenditures. The things that really drive value and should be primary inputs to a model are generally not items such as revenue growth, operating margins, return on investment or the ratio of capital expenditures to sales (although for very large corporations it may be necessary to use these kind of inputs.) The art of modelling involves identifying how changes in the industry structure from capacity additions and demand changes, technology changes, consumer tastes, product life cycles and other

factors affect these value drivers. Modelling and valuation mistakes introduced in Chapter 1 were not due to incorrectly structuring a model or having a financial model that was too simple; they were generally the result of not using valid economic and financial principles in developing industry demand, supply and price inputs to the valuation process. These inputs can be studied by reviewing historic data, performing statistical analysis, applying marginal cost concepts, and considering industry structure. The value drivers should use judgment as to whether sudden non-linear changes can occur, industry expertise and perhaps mathematical simulation.

When developing a model you can distinguish between whether profits and cash flow of a company are primarily driven by demand and market share or alternatively whether financial results are driven commodity prices and cost management. The former type of model can be referred to as a demand driven model while the latter can be called a supply driven model. The starting point for the assumptions should generally be the capacity of the company (reserves of oil, megawatts of electricity) in a supply driven model. On the other hand, the starting assumption is the industry-wide demand for the product in a demand driven model. To demonstrate the difference between demand and supply driven models consider an upstream oil project. The most likely place to begin the upstream model is with the capacity of the oil fields in terms of oil and gas reserves meaning the model is supply-driven. You would probably not begin with an analysis of the worldwide demand for oil because oil prices the company operates in a commodity business and it will most probably sell whatever it can produce. Alternatively, for a company operating in a limited market region that may have market power, the model would begin with demand for the product in the industry and market share of the company. The diagram below illustrates modelling of an electricity plant for a supply driven models. The drivers for capital expenditures, revenues and operating expenses are all determined by the capacity of the plant. Economic drivers of revenue, operating expense and capital expenditures include the cost per unit of building the plant, future trends and volatility in prices, the capacity utilization of the plant; and, the variable and fixed costs of operating the plant. The entire subject in Part 4 addresses how to assess value drivers associated with prices and utilization rates.

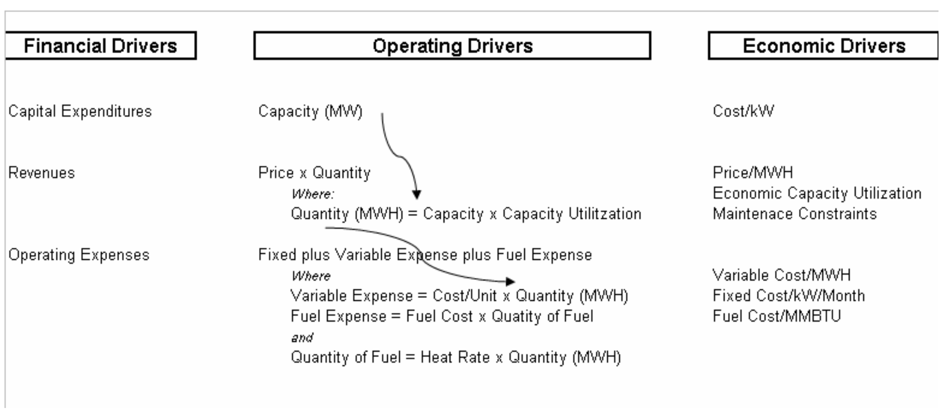


Figure 23

The most common form of corporate and acquisition models are demand driven models where the starting point should be evaluation of industry supply, demand and prices. Many valuation mistakes are made when over-supply occurs in an industry because demand does not increase as expected or high returns prompt excessive new supply. The famous quadrant diagram of return versus cost of capital and growth can be an effective way to think about assumptions in a model. The top right quadrant called powerhouse companies is where companies are growing fast and earning high returns. Unless really strong competitive advantages exist, other firms from over the world will want to enter businesses represented by this quadrant resulting in surplus capacity. When surplus capacity exists in an industry, prices can dramatically move from levels that support high returns on investment all the way down to the short-run marginal cost of production as companies fiercely fight for market share. In thinking about how surplus capacity can arise, the return on investment for firms in an industry along with barriers to entry can be evaluated. If returns are relatively high and entry of new firms is not limited, surplus capacity can come quickly. A recent example of such a phenomenon is the solar manufacturing industry where high

market valuation and strong returns encouraged addition of new capacity. The new capacity led to dramatic price reductions and declines in market value.

Creating a Flexible Structure of Inputs that Allows Changing Dates, Multiple Scenarios, Variables that Change over Time and Portfolios of Assets

In terms of spreadsheet mechanics, inputs should be on the same spreadsheet page (or set of pages) and the relevant input categories should be grouped together. Generally, the inputs should begin with timing parameters followed by operating inputs, financing inputs and valuation parameters. Inputs can be structured on a period by period basis across a spreadsheet page or they can be entered in alternative time increments where users can insert added time periods with alternative values as illustrated below. In a corporate model, the inputs are often entered next to historic values and it may be convenient to use conditional formatting to illustrate the history in a different colour next to the forecast.

The inputs should be set-up in a way that anybody can easily find the inputs and understand exactly what each input means. For example, a model has a input labelled “development percent” may be confusing because one has no idea what is the basis for the percentage. Second, inputs should allow the model to be adjusted and not be restrictive. If there is one inflation rate applicable to all future years, the model has limited flexibility. Third, the inputs should be arranged in a logical manner and grouped together by categories that reflect the structure of subsequent calculations in the model. Assumption sections should include:

1. Timing assumptions corresponding to the different types of models. In project finance models, the key timing parameter is the financial close data, the commercial date, the debt repayment date and the decommissioning date. In corporate models, the timing assumptions are the last historic period, the explicit period and the terminal period.

2. Capital expenditure assumptions that enable a company to grow including the quantity of products generated from the capital expenditures and the cost per unit of the capital expenditures.

3. Revenue assumptions that include the quantity sold and the price where the price can depend on industry capacity and supply analysis described below.

4. Cost assumptions that are separated between fixed and variable cost so that different sales quantity assumptions can be evaluated and the model can measure risks arising from operating leverage.

The above four assumption categories determine the pre-tax return on invested capital in a corporate analysis and the pre-tax internal rate of return in a project finance analysis. These two ratios define the value of the assets of an enterprise. Remaining assumptions are used to derive the after tax return and the return after gearing including the return on equity and the equity IRR.

5. Tax and associated depreciation assumptions including tax rates, depreciation rates and the difficult issue of retirements in a corporate model.

6. Financing assumptions that include the amount of debt issued, the manner in which debt will be repaid, the interest and fees incurred on the debt while it is outstanding and features of the debt such as covenants and reserves that are designed to protect lenders.

One approach to analyse assumptions is to set-up inputs where a model that begins with industry demand and supply as illustrated on the graph below where the capacity additions planned by different companies (the coloured area) are compared to demand demonstrating the potential for overcapacity. Even if inputs for the industry demand and supply cannot be precisely obtained, the idea of understanding projected supply and demand conditions relative to historic levels is an essential conceptual step of the process.

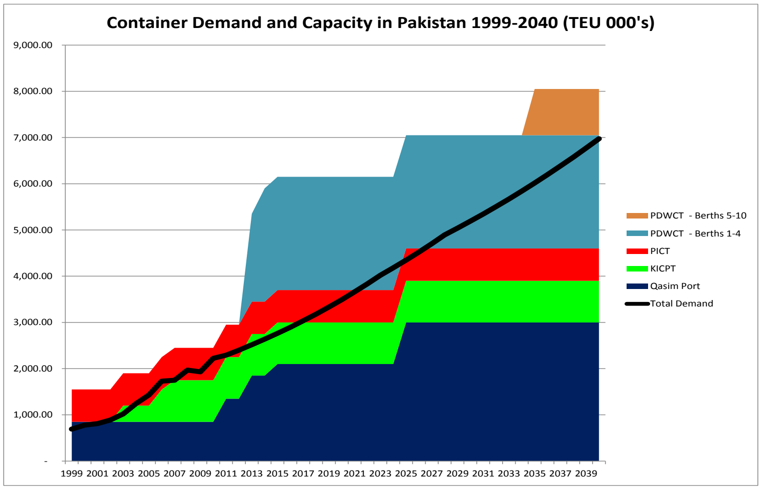


Figure 24

Once the industry supply and demand is established, projections of market share and prices can be estimated for an individual firm. The manner in which volume demand could be established from industry demand estimates could be established from a step by step process something like the following:

Step 1: Compute the industry demand. Possible approaches to compute future demand include regression analysis, evaluation of historic volatility, extrapolation and judgment.

Step2: Compute the industry supply from exiting supply as well as specific knowledge of expected new additions and expected retirements.

Step 3: Compute the industry wide surplus capacity margin and attribute the industry margin to the company to develop company volumes assuming that market share is driven by the capacity of a company relative to total industry capacity as illustrated using the equation below.

Reserve Capacity Percent = Industry Capacity/Industry Demand

Company Demand = Company Capacity/Reserve Capacity Percent

Step 4: Evaluate the price of the product as a function of the reserve capacity percent and the surplus capacity. In creating price assumptions an assumption can be made as to the price level relative to the amount of the surplus capacity. When the surplus capacity is high, the price can fall to marginal cost. To implement changes in prices that result from the relationship between supply and demand, a LOOKUP function can be used. The LOOKUP function is more flexible and stable than either the VLOOKUP or the HLOOKUP functions. The LOOKUP function is illustrated below:

Price = LOOKUP(Reserve Capacity, Reserve Capacity Range, Price Range)

Alternative Input Structures for Project Finance and Corporate Finance Models

The structure of inputs corresponds to the fundamental difference between corporate models and project finance models. Corporate finance models are built from history and virtually every input should be a time series variable that can change from year to year. Further, the assumptions should be displayed adjacent to the history. In displaying the history aside the projected assumption, the assumptions can vary by time period or the assumption can remain constant. The excerpt below illustrates alternative assumptions for a corporate model using this idea. The first assumption for sales growth includes alternative time series

variables that change from year to year. On the other hand the assumptions for working capital apply a single number that does not change from year to year. For sales growth, the different time series are driven by a code number that is shown in red (because it comes from another sheet that has a red tab colour). The fixed number that drives the projection of accounts receivable is also in shown in red, but is not a code number. The idea of using a code number to set up assumptions can be implemented with either the INDEX function or the CHOOSE function as explained in the next section.

Timeline	Base case	2009	2010	2011	2012	2013	2014	2015	2016
Historic timeline switch	13	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE
Assumptions									
Operating assumtions									
Sales growth									
Historic sales		7.70%	-1.04%	7.75%	9.85%	FALSE	FALSE	FALSE	FALSE
Base sales					5.00%	5.00%	5.00%	5.00%	4.50%
Low sales					3.00%	3.00%	3.00%	2.00%	2.00%
High sales					8.00%	8.00%	7.50%	7.00%	6.00%
Sensitivty case				200	2.00%	2.00%	2.00%	2.00%	2.00%
Sales growth code number	1								
Actual/forecast sales growth		7.7%	-1.0%	7.8%	9.8%	5.0%	5.0%	5.0%	4.5%
COGS margin									
Historic margin		53.45%	52.33%	53.12%	53.10%	FALSE	FALSE	FALSE	FALSE
Base margin						53.00%	53.50%	54.00%	54.00%
Low margin						54.00%	56.00%	56.00%	55.00%
High margin						53.00%	52.50%	52.50%	52.50%
Sensitivty case				530		53.00%	53.00%	53.00%	53.00%
COGS margin code	1								
Actual/forecasted COGS margin		53.45%	52.33%	53.12%	53.10%	53.00%	53.50%	54.00%	54.00%
Working Capital Assumptions									
A/R to Sales Historic		6.87%	6.46%	6.69%	8.41%	FALSE	FALSE	FALSE	FALSE
A/R to Sales Projected	8.40%					8.40%	8.40%	8.40%	8.40%
A/R to Sales Actual and Projected		6.87%	6.46%	6.69%	8.41%	8.40%	8.40%	8.40%	8.40%
Inventories to CGS Historic		4.39%	4.50%	5.03%	5.63%	FALSE	FALSE	FALSE	FALSE
Inventories to CGS Projected	5.60%					5.60%	5.60%	5.60%	5.60%
Inventories to Sales Historic and Projected		4.39%	4.50%	5.03%	5.63%	5.60%	5.60%	5.60%	5.60%

Figure 25

In the case of project finance models, the format does not have the same structure driven by history. Some inputs may be annual; some may be one time numbers; some may be switches. An excerpt from project finance model inputs is shown below.

Operating Costs and Inverter Replacement						
Inflation Index for Operating Costs			**2013**	**2014**	**2015**	**2016**
Base inflation rate		1	2.00%	1.50%	1.75%	2.00%
Low inflation rate		2	1.00%	0.75%	1.00%	1.50%
High inflation rate		3	3.50%	3.50%	3.50%	3.50%
Low inflation rate		2	1.00%	0.75%	1.00%	1.50%
Date for Real Operating Expenses	Date	01-nov-13				
Operating Expenses						
Fixed O&M Expense	USD/MWH	15.00				
Other costs	USD 000's	0.00				
Inverter Replacement						
Cost in Real Currency	USD/kW	517.25				
Years to Replacement	Years	25.00				
MRA Switch	Switch	FALSE				

Figure 26

Setting-up Inputs with Code Numbers and the INDEX Function

One of the most important uses of financial models is to develop risk analysis discussed in the next chapter. To prepare the model of risk analysis, one should set-up inputs to the model in anticipation of the risk analysis through entering different possible scenarios in the data input section. For many inputs such as volume growth rates, prices, interest rates and other factors, different scenarios may have changing value over the forecast period. When inputs can take on different values over time, the

mechanical task is to enter input data without inordinately cluttering up the model. An effective way to enter input data with changing values over time and different possible scenarios is to use of forms together with the INDEX or CHOOSE. The general process of setting-up flexible input variables that can change over time at different date increments is summarized below:

Step 1: Enter a scenario number associated with an input. This scenario number will allow you enter an entire row of column of data into the model.

Step 2: Enter data for a series of rows or columns associated with the input that can change over time. When entering the data, there should be some time tag such as a year number or a date that can be used to associate the input with correct columns in the financial model by using a LOOKUP function.

Step 3: On a blank row below the list of scenarios or to the left of the scenarios, use either the CHOOSE or the INDEX functions along with scenario number from step 1 to compute the input variables that will be used in the analysis. These two functions simply find a number from a group of numbers according a given row or column number. Recall that the INDEX function works by shading an area or a group of numbers in a row or column together with a single row or column number that defines which number in the group to select. When using the INDEX function, you should shade the items for one period and then use the scenario number (and lock it with the F4 key for the row or column.)

Selected Value for Period = INDEX(Column of Data for Scenarios, Scenario Code Number)

Step 4: Once the variable is defined, use the LOOKUP function to insert the appropriate variable into the financial model. To use the LOOKUP function, use the relevant time period indicator in the financial model as the look up index. Then shade the time period in the input data and finally shade the items that will be transferred from the INDEX function.

The example below illustrates how to set-up flexible inputs in a project finance context. The top part shows date inputs that drive the different timing switches that are a crucial part of the modelling process. The capacity per turbine are input as fixed inputs which do not change over time (there are typically few inputs that entered as scalars like this in a corporate model). Items where scenario analysis have multiple different values that can change over time can be entered with a code number that defines the scenario. Finally, some inputs can be entered by year even if the model is structured as a monthly or semi-annual model. In this case the timing of the input is flexible according to the date to the left of the input that in turn corresponds to the date timeline. The colours are made using the SHIFT,CNTL,C homemade short-cut key discussed above and the selected scenario can be displayed using CONDITIONAL FORMATTING with the option that allows you to use a formula for making the formatting.

Assumptions

Timing		
Model start date	date	01-nov-10
Development period	months	6
Financial close	date	01-mai-11
Construction period	months	24
Commercial operation date (COD)	date	01-mai-13
Operations		
Capacity per turbine	MW	3
Number of turbines		20
Capacity factor	Code no.	1

periods	date	P50 case
0	01-mai-13	25%
1	01-nov-13	27%
2	01-nov-14	29%
3	01-mai-16	30%
4	01-mai-18	32%

1	2	3	4	5	33
P50 case	**P75 case**	**P90 case**	**P25 case**	**Sensitivty**	
25%	23%	22%	34%	33%	P50 case
27%	25%	23%	35%	33%	P75 case
29%	27%	24%	36%	33%	P90 case
30%	29%	25%	37%	33%	P25 case
32%	30%	28%	39%	33%	Sensitivty

Inflation rate			2010	2011	2012	2013	2014	2015	2016	2017	2018
Code		1									
Base inflation rate		1	2.00%	2.00%	2.50%	2.50%	2.75%	2.75%	3.00%	3.00%	3.00%
Low inflation rate		2	1.00%	1.00%	1.00%	1.50%	1.50%	1.50%	2.00%	2.00%	2.00%
High inflation rate		3	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
Base inflation rate			**2.00%**	**2.00%**	**2.50%**	**2.50%**	**2.75%**	**2.75%**	**3.00%**	**3.00%**	**3.00%**
Date FIT awarded	date	01-nov-12									
Electricity Prices											
FIT	EUR/MWh	60.00									
Indexed	Switch	FALSE									

Figure 27

Chapter 6: Structuring Time Lines and Understanding the Importance of Different Phases in Corporate and Project Finance Models

When filling out applications, discussing your life and evaluating your performance in various tasks ranging from sporting competitions to employment, one of the first questions that you are generally asked is your birth date. The same general notion applies to companies or projects, where dates, ages and life stages go a long way in the programming of a model. The starting point for a well structured financial model should be a carefully defined time line that contains the starting point and ending point of an analysis, just as the most fundamental aspect of a person's life that is reported on his or her tombstone is the date of birth and the date of death.

Efficiently structuring the time periods assures that you can gauge the effect of issues such as the length of the holding periods of an acquisition, delays in the construction of a large project, lengthening of the life of a concession period in project finance, or evaluating the amount of time before which a stable growth rate is achieved for a corporation. From a mechanical perspective, carefully setting-up time periods allows calculations of items such as interest during construction, terminal value, depreciation and amortization, debt service reserve repayments, gain on sale of assets and other items. Much of the flexibility in a financial model comes from carefully setting up a time line.

Timing in Corporate Finance Models – Distinguishing the Historic Period, Explicit Period and Terminal Period so your Model will be Flexible and Adaptable to Financial Updates

A corporate model should contain a historic period, an explicit forecast period, a valuation date, a terminal period and sometimes a fade period. For these models, the structure of time periods should begin with definition of the historic period that is established from the availability of financial statements and allows you to update the model with actual financial data. In corporate valuation and modelling there is a great deal of subjectivity in estimating future growth – you know that high growth cannot last indefinitely simply because of the law of large numbers. But claiming that you know exactly when growth will slow down and how much it will slow is not only arrogant, but fraudulent. When creating a model it is therefore useful to construct the model so as to be able to evaluate different periods before which the explicit forecast period ends.

Corporate models can also be structured to include a fade period in which cash flow growth declines from the rate achieved in the terminal cash flow period until a stable growth rate is obtained. In the fade period

the growth rate in revenues moves from the relatively high short-term growth to a sustainable growth rate over the long-term, the operating margin may move for the current returns to returns that are reasonable to expect in the long-run and capital expenditures move to levels that are consistent with growth rates and the lifetime of the assets. The diagram below illustrates different time periods in a corporate model and the importance of the assumptions developed for the final forecast period.

Terminal Value in Corporate Model

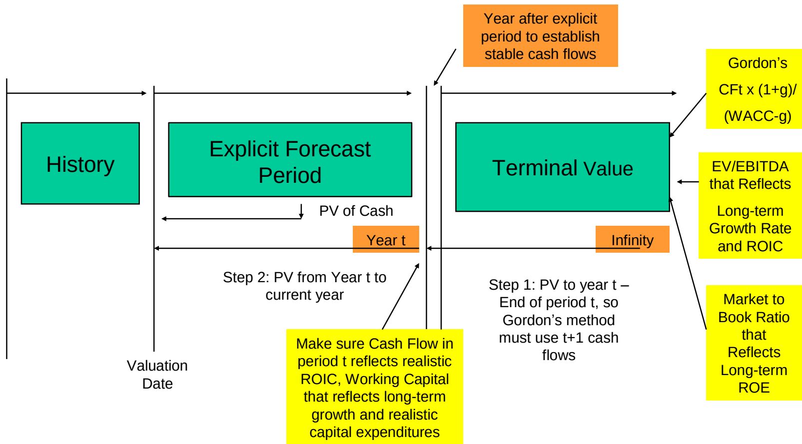


Figure 28

Timing in Project Finance Models - Different Phases in the Life of a Project from Development to Decommissioning

Structuring the dates is particularly important in project finance models where alternative accounting, financing and most importantly risk analysis occurs for different phases of the project. The stages that occur when making a new investment can include the time period when the project is being developed before construction – the development period; the period when construction occurs and investors are putting money into the projects; the period of operation of the project, and finally, the period in which the project terminates. Many mechanical calculations in a model are different for these different time periods. Further, the length of the periods in a model should be flexible and allow for the lengths of various phases of a project such as a delay in construction.

The number of periods can differ in project finance models depending on the phase of the project. In many project finance models, the construction period is presented on a monthly basis in order to accurately measure interest during construction since the calculation requires accumulation of debt for each month. On the other hand, when the plant begins operation, the model switches to semi-annual periods because of debt is repaid on a semi-annual basis. In order to construct time periods, one can create switches that define each phase of the project as well as the important milestone dates such as the financial close and the commercial operation date. The programming of different phases can become quite complex if the milestone dates do not start at the beginning of a month and if there are different time periods modelled in each phase of the project. The key behind making the modelling relatively simple is to make a period code which is one at the commercial operation date, negative during operation and development and measures the age of the project. After the model is created with detailed time periods, it is convenient to show numbers for an annual year, for a semi-annual period or a quarterly period if the model is constructed with detailed monthly periods.

The figure below illustrates how various stages of a project can be modelled with a period code. The interesting theory associated with the different stages is how the value of a project changes as the risk of the project changes at different phases of the project.

- Set-up of Project Finance Model with Different Phases

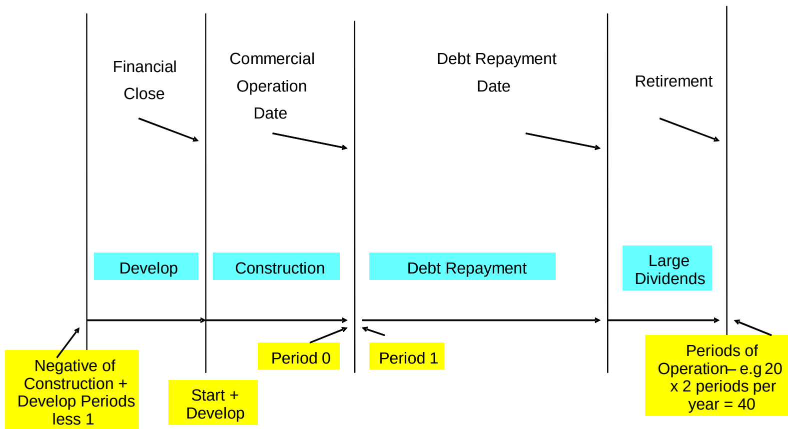


Figure 29

Timing in Acquisition Models – Separating the Transaction Period, the Holding Period and the Exit Period

In the case of acquisition models, setting-up time lines and time period indicators is just as important as corporate or project finance models so as to effectively measure risk and return. For acquisition models, different calculations are made for the acquisition period, the holding period and the terminal period. Through effectively setting-up time periods, a corporate model can be effectively converted into an acquisition model where dates of transactions can occur at different times, different historic periods can be added and alternative holding periods can be simulated. When initially constructing time periods in the model the following guidelines can be followed:

- The acquisition period should be a separate period in the model that only lasts one day so that the mechanics of the on-going calculations are not mixed up with the transaction assumptions.

- The period subsequent to the acquisition period can be a fraction of a year followed by annual periods until the final sale period.

- The exit period can be separate from the holding period in order to isolate on assumptions with respect to the sale of the company.

Developing periods in this manner allows the model to handle movements in the transaction date as well as alternative holding periods of the investment. As with a corporate model, one can evaluate what happens to the rate of return earned on a transaction when the holding period of the transaction changes. With the flexible time periods defined, a J-curve illustrating how the rate of return is affected by the length of time between the purchase and sale can be established as illustrated in the graph below.

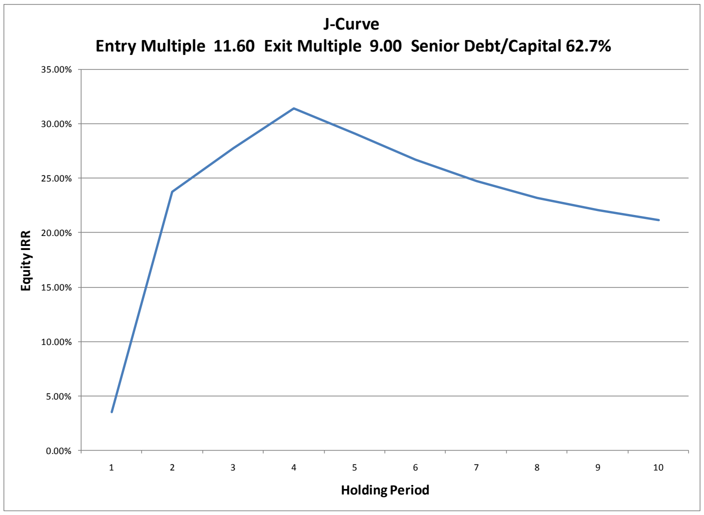


Figure 30

General Ways to Structure a Time Line that Measures History, Explicit Periods and Terminal Periods in Corporate Models and Measures the Phases of the Life of a Project in a Project Finance Model

The remaining part of this chapter addresses mechanical issues with defining time lines, indicators and methods to facilitate different modelling and risk analysis techniques. A few issues that make the time line process more manageable for all project types include:

- Reserve a separate place in the model for the time line, whether on a separate page or a separate place above the beginning of the operating analysis.

- Begin the process by defining some kind of age variable (in your personal life, your age tells a lot about you; before you are born you are assumed to have a negative age).

- Explicitly show the start date and the end date of the model beginning with the first date of history, the date of the financial close or the date of the transaction depending on the model type.

- Explicitly define the periodicity of the model in terms of the number of months per period, the number of periods per year and the number of days per period (using either a 360 day basis with the DAYS360 function or a 365 day basis by subtracting the end date from the beginning date).

- Add switch variables for items such as the construction period in a project finance model and the historic period in a corporate model.

A financial model can be established on different periodic bases – annual, monthly, quarterly or semi-annually. It may seem a bit ridiculous to create a model with monthly information for ten years into the future when it is very difficult to predict what will happen one year from now. However, creating periods that are more finely defined than twelve month increments can be important in avoiding circularity and in reflecting the structure of alternative debt instruments. While it may seem a lot more complex to make a periodic model, with a bit of investment in creating switches and dates, the periodic modelling does not have to be painful.

Using Date Functions to Compute Start and End Dates for Each Period in Financial Models

To set-up a model that includes different project phases as in a typical project finance model, it is useful to begin with a period counter that measures how old the project is in each period (this is not necessary if the timing of the model does not change in different time period). Once the time period is defined, the dates of the model can be presented. These dates can be used to establish the phase of the project. To do this, you can use the following step by step process:

- First, compute the number of periods before commercial operation. Then make a period code starting with a negative number for the pre-operation periods.

- Second, once the period code is defined with a negative number for periods before you are born (i.e. before the operation period), create a TRUE/FALSE switch that delineates the pre-operation period from the operation period. This code that defines the time period before which the project is running (or is born) is created simply by the following statement:

  Period Code: Period > 1

- Third, use the time period code is to define the number of months per period. For example, the months per period may be one during the construction period and six afterwards. You can then use the period switch defined above to determine whether months per period in the model. (The one and the six in the equation below should be defined in the inputs).

  Months per Period = IF(Construction Period, 1, 6)

- Fourth, enter the start date and the end date using the EDATE function as described in the paragraph below. The first beginning date is the established date and the ending date is the EDATE function with using the months per period. Start with the ending period (the first period is the start date of the model) and increment the date using the EDATE function and the months per period.

  Ending Period Date = EDATE(Beginning Period, Months per Period) - 1

  Beginning Period Date = Ending Period Date + 1

In general, it is not useful to work with days when incrementing dates. When increasing a date by one month, the new date cannot be incremented by simply adding days to the prior date (you cannot add 30.5 to the date for the previous month.) Instead of working with days, it is helpful to use the EDATE function or the DATE function. When using the EDATE function, the number of months is used to increment a date: EDATE (prior period, periods per year). If the DATE function is used, the YEAR, MONTH and DAY arguments of the function should refer to the previous date and the period per year should be added to the MONTH argument. Given the definition of periods for year from the switches above, the DATE function would be DATE(YEAR(prior date), MONTH(prior date) + periods per year, DAY(prior date)).

Including TRUE and FALSE Switches like Light Switches to Turn things on and off in Modelling Time Periods

When creating a switch variable that has a value of TRUE or FALSE for a time period phase, you can think of a light switch that is turned on or off. In a project finance model, the construction phase, operating phase, debt repayment phase, and specific dates can be defined using switch variables that are on or off depending on dates defined in the model. In a corporate model, switch variables should be developed for the historic period, the explicit forecast period and the terminal value period. Use of the logical variables that have a value of TRUE or FALSE was already introduced and is essential in the date section of a model. Using the fact that TRUE is equal to one and FALSE is equal to zero can often eliminate the need for long IF statements. A switch can be created by simply using and equal sign (for example, = period or period <= 0). It can also be created using and AND, OR, or NOT function (for example, AND (period > 0, period <= retirement date) defines a switch for when the plant is operating.

Establishing the TRUE and FALSE statements is also effective together with IF statements. One can simply use the TRUE or FALSE in IF statements and make the statements much easier to read.

Mechanically, the definition of various phases in a model can be developed by inputting various dates and then programming variables that contain switches. These switch variables which have a value of TRUE or FALSE can be used to set-up dates and program many variables that differ as a function of the phase of the investment. For example, various items may have different equations for the terminal period in a corporate model. To make programming less laborious you can make a variable that has a value of FALSE for each period except for the terminal period, which has a value of TRUE. An illustration of setting-up time period codes is shown in the excerpt below. In this example, each formula is very short and simple demonstrating the transparency objective of a model that should be easy to follow. When making a switch variable, the time line should not be fixed in the equation, but the criteria should be fixed (using the F4 key) as illustrated below for the terminal period and the explicit period in a corporate model. Assuming the time line is in the first row, the switch is evaluated for column G, and the criteria for the terminal year is in cell D10, the formulas for the switches would have the following form:

Terminal Switch: Timeline Year (G1) = Terminal Date ($D$10)

Explicit Switch: AND(Timeline (G1) > Start Criteria ($D$11), Timeline (G1) <= Terminal Date($D$10))

Note how the fixing of cells works in these formulas. The timeline should not have a dollar sign on the column, but the criteria should be fixed with the F4 short-cut key.

Start of period ☐ Show Comments Fix Base Case					01-déc-12	01-janv-13	01-févr-13	01-mars-13	01-avr-13	01-mai-13	01-nov-13	01-mai-14	01-nov-14
End of period					31-déc-12	31-janv-13	28-févr-13	31-mars-13	30-avr-13	31-oct-13	30-avr-14	31-oct-14	30-avr-15
Year	From	To		Check	2012	2013	2013	2013	2013	2013	2014	2014	2015
Development period	01-nov-10	01-mai-11	6	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Financial close date	01-mai-11	01-mai-11	1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Construction period	01-mai-11	01-mai-13	24	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE
Commercial Operation Date	01-mai-13	01-mai-13	1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
Month before COD	01-avr-13	01-avr-13	1	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE
Operation period	01-mai-13	01-mai-33	40	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE
Debt Repayment Period	01-mai-13	01-mai-26	26	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE
Debt Retirement Period	01-mai-26	01-mai-26	1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Re-financing Date	01-mai-17	01-mai-17	0		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Re-financing Repayment Period	01-nov-17	01-nov-30	26	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Figure 31

Examples of use of the switch variables later on in the model (which are either zero or one) include:

Construction Expenditures = Total Cost/Construction Period x Construction Period Switch
Debt Balance = IF(historic period, actual amount, opening balance – repayments)
Terminal Proceeds = Terminal EV/EBTIDA Ratio x EBITDA x Terminal Switch
Interest during Construction = Interest Accrued x Construction Switch
Stable Capital Expenditures = Capital Expenditures/Depreciation x Depreciation x Stable Switch

Once you are finished defining the detailed time periods, you can create an annual page that computes all or the variables on an annual or quarterly or semi-annual basis. This process involves using the SUMIF or the SUMIFS function along with clicking on entire rows of the spreadsheet page with detailed analysis (the page shown above). The way in which this process can be transparent and relatively simple is described in the next part of the book under the sensitivity graph heading (as the annual numbers are often used to create graphs).

Annual Date = SUMIF(year row in periodic model, year in annual model, item in periodic model)

Computing the Age of a Project in Years in a Periodic Model that is Computed on a Monthly, Quarterly or a Semi-Annual Basis

When developing a model where time increments are not expressed on an annual basis (e.g. a monthly model or a quarterly model), it is sometimes useful to express the age of a project or an acquisition in

years. Many inputs such as the credit spread, the operation and maintenance expense, production changes, the extraordinary maintenance and other variables depend on the age of a project rather than the calendar year and these variables are often expressed on an annual rather than a periodic basis. Computing the age of a project in years seems to be a simple issue, but it can be a little tricky. This is particularly true in cases where the number of periods is not constant over time; for example where a detailed monthly analysis is deemed necessary for the initial few years of a project life after which a quarterly model is used.

To compute the age of a project in years, you can use a simple two-step process is helpful. The first step is computing a variable that simply counts the number of periods (months, quarters, semi-annual periods) in the year. For example, in a monthly model, you would count from one to twelve and in a quarterly model you would count from one to four for each year in the model. The second step is to compute an age variable in years which increases once a new year has been reached. Increases in the age occur when the counter variable has a value of one. Difficulties in this process involve making sure that the counter begins with a value of one at the start of commercial operation and that counter variable re-starts when the periods of the model change. This step-by-step process is illustrated below:

Step 1: Compute a period counter variable. In a simple project finance model, this could be calculated using an IF statement where the counting re-starts after the maximum number of periods is reached:

IF(last period counter = maximum periods, reset to one, increment counter by one)

Step 2: Increment the age variable when the counter is equal to one. This is simply like having a birthday on one day (or month, or quarter) and increasing your age in years on your birthday.

IF(counter variable = 1, increase age, don't increase age)

The Magic of Using a Historic Switch in a Corporate Model

The historic switch maybe the most essential concept in efficiently designing a corporate model. The most painful part of a corporate model is generally acquiring historic data (sometimes from copying PDF files) and finding the data for plant balances, maintenance capital expenditures, production levels and so forth. The last thing you want to do is to have to repeat this process over and over again each period new data becomes available. The time period switch can be established by using a simple logical variable just below the time period as follows:

HISTORIC SWITCH: (Year <= Last Historic Year)

Placing a historic switch at the top of the page just below the years of the model allows you to do the following:

- You can change the last historic year and seamlessly add another year of data without having to change any of the formulas; without having to add columns and without having to change the valuation formulas in the model. When entering a formula for things like accounts receivables to revenues, you can make a formula that uses the historic switch as follows:

  Historic A/R to Revenues = IF(HISTORIC SWITCH, A/R Level/Revenues)

  This formula produces a value of FALSE for periods after the historic period and will update the calculation when new data is entered as subsequent data becomes available. Often it is helpful to leave out the false condition in an IF statement and allow the model to present FALSE when something cannot be calculated. Using the above equation, the FALSE shows up in the projected years.

- You can model miscellaneous items such as other income as the last historic level or as a fixed level of zero by using another IF function as follows:

Historic/Projected Other Income = IF(HISTORIC SWITCH, Historic Level, Prior Level)
or

Historic/Projected Other Income =
IF(HISTORIC SWITCH, Historic Level, AVERAGEIF(HISTORIC SWITCH, TRUE, Historic Amount)
or

Historic/Projected Other Income = IF(HISTORIC SWITCH, Historic Level, Fixed Input Amount)

If the a fixed level is used, the fixed level should be shown in a cell at the left of the historic data after the titles.

- You can enter assumptions that have different levels for different years by using the INDEX function together with the HISTORIC SWITCH. An effective way to present assumptions is to show the historic level and then a series of different possible assumptions using a scenario code. In this case the formula is a bit long but very useful:

Historic/Projected Price = IF(HISTORIC SWITCH, Historic Level, INDEX(Scenario Column, Code))

- For other assumptions where the number can be constant such as accounts receivable to revenues, depreciation rates, earnings rates on associated investments, variable general and administrative costs and so forth, it is often simpler to enter a single number rather than a time series of changing assumptions over time. In this case the historic switch is used again, except that the second part of the if statement contains a fixed value. This fixed value should be shown in a separate cell to the left of the historic data between the titles.

Historic/Projected Rate = IF(HISTORIC SWITCH, Historic, Fixed Level)

- For some assets and liabilities that are held constant after the historic period, the HISTORIC SWITCH can be used with an IF statement to hold the values at the value of the last historic balance sheet using the following formula:

Historic Projected Balance = IF(HISTORIC SWITCH, Historic, Prior Level)

The excerpt below illustrates the various different ways the HISTORIC SWITCH can be used in developing assumptions and presenting the forecast next to the assumptions. The simple incorporation of a time switch allows the presentation of assumptions to be more transparent and the time switch also makes the model flexible with respect to the addition of new time periods when more data becomes available. The formula in column H illustrates how the historic switch in row 2 is used to develop different types of assumptions.

	E	F	G	M	N	O	P	Q	R
1	Year			2010	2011	2012	2013	2014	2015
2	Last Historic Period	2012		FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
3	Historic Switch Base Case		=M1<=$F$2---->	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE
177	***Revenue Assumptions***								
178	Steel Price								
179	Steel Revenues	USD Mil		12,951	16,044	14,208	0	0	0
180	Historic Price	USD/Ton	=IF(I3,I7/I9*1000)---->	881.14	1,053.31	997.05	FALSE	FALSE	FALSE
181									
182	Base Price Case						**950.00**	**940.00**	**950.00**
183	Low Price Case						**900.00**	**800.00**	**750.00**
184	High Price Case						**1,050.00**	**1,100.00**	**1,150.00**
185	Price Sensitivity Case						**1,060.00**	1,060.00	1,060.00
186	Base Price Case	1	=IF(J3,J180,INDEX(J182:J185,$F$186))---->	881.14	1,053.31	997.05	950.00	940.00	950.00
187									
251	Variable G&A Expenses			381	556	480			
252	Historic Variable Cost as Pct of Revenues			2.84%	3.39%	3.26%			
253	Projected Variable SG&A Expense Percent	3.25%					3.25%	3.25%	3.25%
254	SG&A Variable Cost - Historic and Projected		=IF(I3,I252,I253)---->	2.84%	3.39%	3.26%	3.25%	3.25%	3.25%
255									
367	Assumptions for Income Items Not in EBITDA								
368	Other Income Statement Items								
369	Loss on Disposal/Impariment of Assets		=IF(I3,I21+I22,AVERAGEIF(3:3,TRUE,369:369))	199.00	154.00	469.00	290.29	290.29	290.29
371	Other Gains/Losses	0	=IF(I3,I30+I31+I32+I33,$F$371)---->	(3.00)	(351.00)	272.00	-	-	-
372									
373	Income from Associated Investments								
374	Historic Income			21.00	55.00	1.00	-	-	-
375	Historic Balance Sheet Associated Investments			688.00	663.00	561.00	-	-	-
376	Average Balance of Associated Investments		=AVERAGE(H375:I375)---->	661.00	675.50	612.00	280.50	-	-
1560									
1561									
1562									

Figure 32

The HISTORIC SWITCH is also useful in after the inputs are developed and the working section to compute EBITDA or to compute depreciation and debt issues are developed. In computing items where growth rate assumptions are made, the growth rate assumption can be entered first and then the amount can be derived with the HISTORIC SWITCH as follows:

Projected Amount = IF(HISTORIC SWITCH, Actual, Prior Year Amount x (1 + Growth Rate))

When working through assumptions it is useful to test whether all accounts have been included and whether the historic amounts computed correspond to the historic amounts reported in the financial statements. If the EBITDA is computed as revenues less operating expenses other than depreciation, the difference between the computed level and the reported level can be computed. Then, the difference can be summed over the historic period using the HISTORIC switch using the SUMIF function as follows:

Sum of Differences versus History = SUMIF(HISTORIC SWITCH, Computed difference).

Once the sum of the difference is computed, a test can be developed by testing whether the sum is equal to zero:

Test of History: Sum of Difference = 0

In creating various accounts in a corporate model such as the plant balance, the cash balance, the debt balance, the equity balance and others, the HISTORIC SWITCH can be used to move seamlessly from reported levels to projected levels. For historic years, the closing balance should come directly from the balance sheet while for projected years, the closing balance is the opening balance plus changes that are projected for the current period. Using the HISTORIC SWITCH in this manner is illustrated with the formula below:

Closing Balance = IF(HISTORIC SWITCH, historic amount; opening balance + change)

Transferring Data from a Corporate Model to an Acquisition Model Using MATCH and INDEX Functions

One of the most useful techniques in excel that can be applied in many circumstances is using the MATCH and INDEX function together. An application of this technique is to create flexible timing of an acquisition model derived from a completed corporate model. Say a corporate model is computed with annual or quarterly data. Then you would like to transfer data into a new sheet that corresponds to an

assumed transaction date for an acquisition (that may be in the middle of the period) you can use the following approach.

- Define a valuation date and the periods per year in the valuation analysis through creating a time line corresponding to the above methods that use the approach of a starting date and an un-even date using the procedures described above.

- Assuming the corporate model is computed on an annual basis and the acquisition model will be computed on a quarterly or a monthly basis, the YEAR function can be first used to define the yearly data to be transferred.

- Once the year is established the MATCH function that finds a row or column number can be used to associate dates in the acquisition model page with the corporate model. The best way to use the MATCH function is to not worry about shading partial columns and fixing ranges, but to use the entire row which finds the column number associated with the year from the corporate model:

Column Number = MATCH(year in acquisition model, Entire row of years in corporate model)

- Once the column number is established from the MATCH function, you can use the INDEX function that simply finds a variable given a row or column number or both. For example, assume the revenues are being transferred, then the INDEX function can be used as follows.

Revenue = INDEX(Annual Revenues, Column Number from Above)

	A B C	D	E	F	G	H	I	J	K	L
1	**Dates**									
2	Start Date			01-mai-12	01-janv-13	01-janv-14	01-janv-15	01-janv-16	01-janv-17	02-mai-17
3	End Date	Downside Case	01-mai-12	31-déc-12	31-déc-13	31-déc-14	31-déc-15	31-déc-16	01-mai-17	01-mai-17
4	Year		=YEAR(F3)---->	2012	2013	2014	2015	2016	2017	2017
5	Column from MATCH	Comment	=MATCH(P4,'Corp Model'!2:2)---->	17	18	19	20	21	22	22
6	Holding Period Switch		=F2<='Transaction Assumptions'!$F$7---->	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE
7	Terminal Period Switch		=AND(F3='Transaction Assumptions'!$F$7,F6)---->	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
8	Fraction of Year		=YEARFRAC(F2,F3+1)---->	67%	100%	100%	100%	100%	34%	0%
9	**Operating Section**									
10										
11	Annual									
12	Revenues using INDEX function		=INDEX('Corp Model'!292:292,I5)*I6---->	1,298.71	1,243.05	1,301.65	1,919.38	2,094.44	2,326.23	0.00
13	Expeses using INDEX function		=INDEX('Corp Model'!294:294,I5)*I6---->	1,315.67	1,260.93	1,276.60	1,903.92	2,041.99	2,275.42	0.00
14	Capital Expenditures			72.72	73.45	74.55	824.08	104.77	106.87	0.00
15	Synergies		='Transaction Assumptions'!$F$78*F6---->	80.00	80.00	80.00	80.00	80.00	80.00	0.00
16	EBITDA		=F12-F13+F15---->	63.05	62.12	105.05	95.46	132.45	130.81	0.00
559										

Figure 33

Chapter 7: Projecting Inflation, Revenues, Expenses and Capital Expenditures in Working Analysis

In constructing the working section of a model that projects essential free cash flow items – revenues, operating expenditures and capital expenditures, making clear presentations using short formulas that are easy to follow should guide the modelling process. If available, the working analysis should begin with capacity and demand where the amount of new capacity is directly tied to the demand. Many items in the working analysis section are modelled using the time period switches discussed above. For example, in a project finance model the capacity of a project begins during the operating period which is defined with a switch. In a corporate model, the gross margin is computed using actual data with the historic switch and then switches to the assumptions when the historic period is FALSE.

When computing formulas for inflation projections associated with these items, various problems can arise when time period lengths change and when intervals are used for inputting the inflation rate and when the starting point for inflation indices are not clearly laid out in the input section. In general inflation should be included in the analysis as it is more difficult to convert depreciation and taxes into real terms

than add inflation and use the nominal cost of capital. Interest rates and inflation rates are generally input into a model as annual rates. But when modelling inflation rates using non-annual periods, it is not accurate to simply compute the fraction of the year and multiply this by the annual percentage in a periodic model. This can result in overstatement of interest or inflation because amounts will be compounded in a model. For example, assume the annual inflation rate is very high, say 120%. If the real expenditure for the year before the year's inflation is 100, then it would be 220 including the inflation. If 10% is assumed per month, then by the end of a year with, the inflation index compounds to 3.38 resulting in a value of 338 rather than 220. To resolve this problem of over-compounding, a periodic rate can be derived using the following process.

End of period expenditure = Beginning of period x (1+periodic rate) ^ periods

and,

End of period expenditure = Beginning of Period x (1 + annual rate)

or,

(1+periodic rate) ^ periods = (1+annual rate)

(1+periodic rate) = (1+annual rate) ^ (1/periods)

periodic rate = (1+annual rate)^(1/periods) - 1

To practically apply the above formula, you can use the fraction of a full year that the model period represents as illustrated in the formula below:

Periodic Rate = (1+annual rate)^(months per period/12) - 1

Finally, when establishing the inflation rate one should be careful about the start date. When inflation assumptions are made, the fundamental data for prices, operating expenses and capital expenditures per unit are is input in real terms at some given date. To start the inflation index at the appropriate date, you can create a switch and only turn on the inflation rate after the inflation start (this will keep the inflation index at one until the beginning of the inflation period.) The diagram below illustrates components of a working analysis with varying inflation.

	A B C D	E	H	J	L	M	AJ	AK	AL	AM	AN	AO	AP
4	***Months in period***					1	1	1	1	1	1	1	1
5	***Periods per year***					12	12	12	12	12	12	12	12
6	***Start of period***						01-sept-12	01-oct-12	01-nov-12	01-déc-12	01-janv-13	01-févr-13	01-mars-13
7	***End of period***					31-oct-10	30-sept-12	31-oct-12	30-nov-12	31-déc-12	31-janv-13	28-févr-13	31-mars-13
8	***Year***						2012	2012	2012	2012	2013	2013	2013
206	Real FIT	EUR/MWh	Base FIT				60	60	60	60	60	60	60
207	Annual Inflation rate				=LOOKUP(O8,$I$53:$Q$53,$I$57:$Q$57)---->		2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
208	Periodic Inflation rate				=(1+O207)^(1/O5)-1---->		0.21%	0.21%	0.21%	0.21%	0.21%	0.21%	0.21%
209	Inflation Index	Start Inflation	01-nov-12		=M209*(1+N208*(N6>=$H$209))---->	1	1.000	1.000	1.002	1.004	1.006	1.008	1.010
210	Nominal FIT	EUR/MWh			=P206*P209---->		60.00	60.00	60.12	60.25	60.37	60.50	60.62

Figure 34

Valuation Analysis after Computing EBITDA from Revenues and Expenses and Evaluating Pre-tax Project IRR in Project Finance Models or Pre-tax ROIC in Corporate Models

Once you have computed revenues, expenses and capital expenditures you can stop and compute a few financial ratios. In a project finance model you can calculate the pre-tax project IRR from EBITDA minus capital expenditures. In corporate models you can compute the level of EBITDA to net assets that generate EBITDA. In project finance models, if the pre-tax IRR that can be computed on a real and

nominal basis is lower than the interest rate, then you do not have to go any further with all of the tax and financing aspects of the model as the project will probably not be feasible. On the other hand, if the pre-tax project IRR yields a very high number, you should step back and ask yourself what makes you so special and why this high IRR will not prompt companies from all over the world to try and copy your project which will put a whole lot of pressure on prices, margins and fixed price contracts.

In a corporate model, computing the level of EBIDA to net assets accomplishes a similar task. The net assets can be computed from the accumulated capital expenditures. Once the ratio is computed which is analogous to the pre-tax IRR, the projected levels can be compared to the historic ratio. This notion of comparing history with projection is further discussed in Part 3 and allows you to judge whether you have made reasonable assumptions. If the rate of return on assets skyrockets compared to the history you need to ask what has changed about the company that allows it to earn such high returns. What you probably need to do in this case is go back and revisit your assumptions.

Chapter 8: Moving from EBITDA and Capital Expenditures to Free Cash Flow through Creating Working Capital Analysis, Fixed Asset Schedules and Depreciation so that Project IRR and ROIC can be Calculated

You may be repulsed by the idea of Miller and Modigliani or may be a true believer in free cash flow and the irrelevance of the financial structure in assessing value. No mater what your opinion of the theory, the general approach of separating a financial model between operations and financing improves the structure of any financial model including project finance models, corporate models and acquisition models. Through first calculating free cash flow and only then adding the debt and equity split in the model, the structure is more logical and rigorous. Once free cash flow is computed from EBTIDA less capital expenditures, working capital changes, operating taxes and changes in deferred taxes, a host of valuations and financial statistics can be calculated. In a project finance model the project IRR (but not the equity IRR) can be computed and the value of the project assets at different sale dates can be evaluated. In a corporate finance model the return on invested capital (but not the return on equity) can be derived and the discounted cash flow value can be established. Given the usefulness of separating operating cash flow from equity cash flow, the next section addresses working capital, depreciation and deferred tax items that are necessary to complete the free cash flow calculation.

Working Capital Analysis

Once revenues, expenses and capital expenditures are established, the remaining items to compute free cash flow are the working capital changes and taxes. Working capital is often computed in a simple manner directly from revenues and operating expenses in a simple way through inputting the ratio of accounts revenues to revenues, inventories to cost of goods sold and so forth. For this purposes of constructing a model, working capital includes trade working capital and does not include cash, short-term securities, short-term debt or current maturities of long-term debt. For example, if the days outstanding are 30, then one month of revenues is not collected, or about 8.33% of total revenues. The working capital section must be developed after revenues and expenses have been computed. After computing the total current assets and current liabilities, working capital is computed as the difference between the two amounts. Finally, the change in working capital is the current period working capital less the prior period working capital.

One complexity in computing working capital can involve computing inventories and accounts receivable during periods of declining demand such as occurred after the financial crisis of 2008. In a detailed model, the production can be computed separately from demand. Additions to inventories can be modelled as a function of production while deductions from inventories can be modelled as a function of

demand. If there is a sudden reduction in demand without a similar reduction in production, the inventory balance will increase.

Basic Asset Schedule and Introduction to Problems in Computing Depreciation Expense in Corporate Models Involving Retirements

In corporate finance models project finance models and acquisition models a well structured analysis will calculate free cash flow before incorporating financing of assets. There should be a clear distinction between financing and operating analysis consistent with finance theory. The basic free cash flow definition -- EBITDA less working capital changes, less capital expenditures and less operating taxes can guide analysis before financing. Previous discussion covered the modelling of revenues, expenses, capital expenditures and working capital that are all components of the free cash flow calculation. The remaining item necessary to compute free cash flow is the level of operating tax defined as the tax rate multiplied by the EBIT. This is a hypothetical amount of tax that would be paid if the company were financed entirely with equity and had no interest expense, interest income or income from other activities not related to operations. In order to calculate EBIT and derive operating taxes a projection of depreciation expense is necessary. Therefore, calculating the plant assets along with depreciation is the next logical part of the structure of financial models.

Accurately representing depreciation expense in a model is important because tax depreciation effects actual tax payments; because depreciation expense affects taxes used in computing free cash flow; because depreciation expense is used in terminal value calculations where the ratio of capital expenditure to depreciation expense may be used in computing stable ratios; because depreciation expense effects reported earnings; and because the net plant depreciation rate can be used it deriving stable EV/EBITDA ratios. Unfortunately, the calculation of depreciation in a corporate model can be one of the most tricky aspects of the whole process. Much of the discussion in Part 3 of the text associated with stable ratios in a discounted cash flow analysis and computing the implied EV/EBITDA ratio builds from ideas presented in this chapter.

A few difficult programming issues can arise in modelling depreciation expense in the different types of models. The biggest problem is in corporate models related to evaluating the effects of asset retirements that come about because of historic capital expenditures that were made before the start of the forecast period. Further, the retirements for projected capital expenditures must look backward to the time at which the capital expenditures were made. If the depreciation rate is not straight line, the age of each tranche of capital expenditure must be remembered so that one can look-up the appropriate depreciation rate. For a project finance model, the retirement problem for existing assets does not exist because there is no history. However other programming problems arise because the depreciation expense may be a function of the calendar year rather than the annual age of the project. Depending on the tax treatment of a transaction, distinguishing tax depreciation and book depreciation can be difficult and modelling accelerated depreciation can create challenges in acquisition models. Many of these difficult modelling issues associated with depreciation can be resolved with a few user defined functions. These functions include:

- Vintage depreciation given capital expenditures and depreciation rate
- Depreciation rate on net plant give life and growth rate
- Implied retirements from historic growth rates
- Implied historic growth rates from accumulated depreciation to gross plant

Portfolios of Assets with a Vintage Process

Corporate models may include tax depreciation as well as book depreciation as tax depreciation rather than book depreciation affects true taxes paid and cash flow. If EBIT is computed using book depreciation in the free calculation, then there should be a separate adjustment for changes in deferred taxes derived from calculation of tax depreciation in the calculation. The more correct calculation is:

FCFF = EBITDA - WC Change - Capital Expenditure - EBIT x tax rate + Change in Deferred Tax

Computation of tax depreciation can be complex when the depreciation rate is not constant for each year if accelerated depreciation rates are part of the tax code. To model tax depreciation with accelerated rates and continuing capital expenditures, a matrix with a diagonal pattern is often shown in models as the depreciation expense for an asset depends on its age implying that information on both the age and the capital expenditure must be retained for the calculation. These fancy looking matrices are sometimes shown for straight line depreciation which is not necessary as the depreciation rate does not depend on the age of the asset (perhaps modellers want to show how sophisticated they can be). The table below illustrates calculation of accelerated depreciation for assets with an assumed four year life.

Model Year		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Capital Expenditure		200.00	218.00	237.62	259.01	282.32	307.72	335.42	365.61	398.51	434.38	473.47
	0	1	2	3	4	5	6	7	8			
Dep Rate		14.29%	14.29%	14.29%	14.29%	14.29%	14.29%	14.29%		100.00%		
Yr Born	Expenditure											
2014	200.00	28.57	28.57	28.57	28.57	28.57	28.57	28.57	-	-	-	-
2015	218.00	-	31.14	31.14	31.14	31.14	31.14	31.14	31.14	-	-	-
2016	237.62	#N/A	-	33.95	33.95	33.95	33.95	33.95	33.95	33.95	-	-
2017	259.01	#N/A	#N/A	-	37.00	37.00	37.00	37.00	37.00	37.00	37.00	-
2018	282.32	#N/A	#N/A	#N/A	-	40.33	40.33	40.33	40.33	40.33	40.33	40.33
2019	307.72	#N/A	#N/A	#N/A	#N/A	-	43.96	43.96	43.96	43.96	43.96	43.96
2020	335.42	#N/A	#N/A	#N/A	#N/A	#N/A	-	47.92	47.92	47.92	47.92	47.92
2021	365.61	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-	52.23	52.23	52.23	52.23
2022	398.51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-	56.93	56.93	56.93
2023	434.38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-	62.05	62.05
2024	473.47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-	67.64
Total		28.57	59.71	93.66	130.66	170.99	214.95	262.87	286.53	312.32	340.42	371.06
		28.57	59.71	93.66	130.66	170.99	214.95	262.87	286.53	312.32	340.42	371.06

Figure 35

To model one of these matrices, the biggest trick is to compute the age of separate assets that are projected to be completed at different times. In the above example, the age of the asset class that goes into service in 2015 is one year old in 2015, while the age of the asset class that went into service in 2014 is two. A square can be created that shows the date the asset is born and the date of the model that allows the age at each vintage to be computed. Once the age of each vintage of plant for each asset class is established, the LOOKUP function can be used with the age as the index to find the appropriate depreciation rate. To make the calculations, the following steps can be used:

Step 1: Enter the depreciation rate as a function of the age of the plant.

Step 2: Use the TRANSOPSE function (not the copy and paste special) to set up a matrix that has the year the asset was created on the column and the year of the model on the row. To apply the TRANSPOSE function, first shade the target area, then type the function name and finally press SHIFT, CNTL, ENTER instead of simply pressing the enter key. The result called an array variable will include brackets around the result.

Step 3: Compute the age of the plant through subtracting the model year from the year the asset was born. Allow the age to be negative in years before the asset was created (use relative references by pressing the F4 key multiple times)

Step 4: Use the LOOKUP function to relate the depreciation rate to the vintage of the plant by applying the age as the lookup index and then shading the age in the depreciation table and then shading the rate.

Step 5: Multiply the depreciation rate by the cost of the asset being depreciated from the cost of the asset that was created from the TRANSPOSE function and use the IFERROR function (in excel 2007 and later) to avoid problems created by N/A.

Step 6: Repeat the process for assets with different vintages and with book and tax depreciation.

Instead of this rather long process, you can create your own function with a few lines of code that accepts capital expenditures and depreciation rates and produces the depreciation expense. You do not show the fancy diagonal matrix, but the modelling is much faster. The function is like the TRANSPOSE function in that the output – period by period depreciation expense -- does not go into one cell, but rather into an array of cells. This means that you must press SHIFT, CNTL, ENTER when you are finished entering the function. To create a function that produces a row or column of depreciation expense from an array of capital expenditures and an array of deprecation rates, you need to know a couple of tricks in computing an array function. Three elements in generating an array function include:

1. Define the function as a VARIANT
2. Compute the length of the array by using the .COUNT extension
3. Create an array variable for depreciation expense using the REDIM statement to define the size of the depreciation array
4. Assign an array variable to the name of the function (rather than a single value)

Once you know these things you can create many sophisticated functions that can make your models far more efficient. The code that produces total depreciation from computing vintages uses two FOR NEXT loops to create and age matrix and then sum the depreciation rate for different vintages across vintages is shown below. The good thing about functions like this is that after you create them one time you will not have to program them again. Hopefully, this example illustrates the benefits of using functions in excel. You can copy this function into your models or you can create an add in file that contains all of your functions.

```
Function depreciation(capital_expenditure, depreciation_rate) As Variant     ' When the output is an array define as Variant

asset_life = depreciation_rate.Count                   ' Find Life from the depreciation rate array
cap_exp_periods = capital_expenditure.Count            ' See how many capital expenditure periods are modelled

ReDim Depreciation_Expense(cap_exp_periods) As Single  ' Make a new array variable that is the output

For model_year = 1 To cap_exp_periods                  ' loop around each period

    For vintage = 1 To cap_exp_periods                 ' make a second loop to evaluate asset by asset

       age = model_year - vintage + 1                  ' calculate the age of each expenditure (the diagonal)

       If (age > 0 And age < asset_life) Then          ' Only when asset is alive
            Depreciation_Expense(model_year) = _
                capital_expenditure(vintage) * depreciation_rate(age) + Depreciation_Expense(model_year)
        End If

    Next vintage                                       ' Note that the vintage is usef for the capital expenditure

Next model_year

depreciation = Depreciation_Expense

End Function
```

Figure 36

The function that produces an array in the above case only allows you to create the function in a single row. If you would like to output a row as well as a column, the output variable can be defined as a two dimensioned array. An additional loop could then be created that defines the second part of the array as using the same value as the first as illustrated below:

```
ReDim Depreciation_Expense(cap_exp_periods,cap_exp_periods) As Single

For i = 1 To cap_exp_periods
        For j = 1 To cap_exp_periods
           Depreciation_Expense(i,j) = dep(i)
        Next j
Next i

depreciation = Depreciation_Expense
```

To implement a user defined function it is helpful to describe the inputs to the function with descriptive variable names and then use the f_x thing next to the data entry box. Then you can see the variables required by your function as illustrated below.

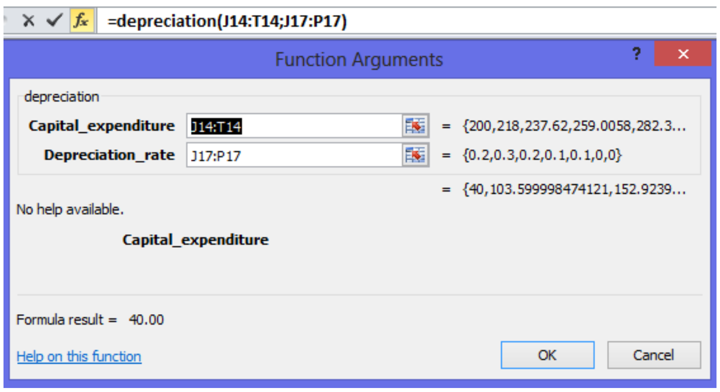


Figure 37

This function can also be used in project finance models where the timing of future capital expenditures is variable. In this case, you simply select the entire series of future capital expenditures all of which can be zero except one. As with the function in the corporate model, you press SHIFT, CNTL ENTER when you are finished and the entire depreciation array is computed.

The Painful Problem of Coming Up with a Method the Accounts for Asset Retirements in Corporate Models in an Unbiased Manner

Addressing the problem of asset retirements in corporate models is difficult because information on the plant retirements associated with previously built pant is difficult to obtain as it depends on previous capital expenditures that occurred a long time ago, write-offs, asset sales and revaluations for many historic years. As this information is virtually impossible to obtain, modellers have developed various different methods to address the problem. Modellers generally firmly believe in their approach and have elegant arguments to support their position. But they cannot really prove their method is accurate. In this section different methods for simulating depreciation and incorporating retirements are addressed.

To measure the benefits and problems of alternative depreciation modelling methods, it is useful to develop a long-term hypothetical model that computes the theoretically correct level of depreciation expense that can be used as the basis of comparison in evaluating different methods. When developing this theoretical model of the true depreciation expense you should keep in mind the most fundamental aspect of corporate models. That is the fact that corporations have a history, an indefinite life and that the model cannot cover all of the periods of the model. A theoretical model that covers the start-up of the

firm, a historic period, a modelled period and a long-term stable period can be used to prove which modelling method is accurate in modelling capital assets, retirements, depreciation expense and net plant depreciation rates. The theoretical model that includes different growth rates for each period can produce the true depreciation, the true retirements and the true cash flow for alternative start dates given assumptions with respect to the life of assets and various growth rates. Once this theoretical base is established, alternative methods can be tested against the true value. One can evaluate what kind of growth rate assumptions produce big errors and if alternative approaches can be developed.

In developing a theoretical base, one can input different growth rates for different periods (the historic period, the modelled period and the long-term period). The growth rates are used to determine the balance of plant that is required to support the EBITDA (if there is a higher growth rate in EBITDA, a higher growth rate in plant is necessary). The plant balance can then be used to derive the implied level of capital expenditures. This is a bit tricky because the change in plant includes the retirements of plant. The capital expenditures are given by the formula:

$$\text{Change in Plant} = \text{Plant}_1 - \text{Plant}_0 = \text{Capital Expenditures} - \text{Retirements}$$

$$\text{Capital Expenditures} = \text{Plant}_1 - \text{Plant}_0 + \text{Retirements}$$

Retirements can be determined by the amount of money spent on capital expenditures in earlier periods. For example if the plant life is five years, then retirements are the amount of capital expenditures that occurred five years ago. When simulating retirements as the lag in capital expenditures, one problem is that retirements cannot be computed until a full life cycle of plant has completed. The first part of a formula for retirements should therefore be an IF statement involving whether the year is greater than the life of the plant – before the cut-off year there are no retirements related to the capital expenditures. When the period is greater than the lifetime, the retirements can be computed. After the first life cycle is complete, retirements should look backward from the current year by the length of the life of the plant. Looking backward can be accomplished using the OFFSET function that begins with a cell and moves up or down and backward or forward:

Retirements = IF(Year >= Asset Life, OFFSET(capital expenditure cell,0,-Asset Life))

The remaining problem with retirements is that the retirements associated with the initial gross plant must be simulated. To do this one can assume that the historic gross plant was accumulated through making capital expenditures at a constant growth rate. This can be accomplished by deriving the capital expenditures that were made a lifetime ago that sum to plant balance assuming the growth rate is applied. You could compute this amount by making a little model and then using the GOAL SEEK function. But this would be tedious to put into all of your models. Instead, you can create a flexible function that does the same thing as the goal seek. The trick to making a function that does the same thing as a goal seek is to make a FOR NEXT loop that has a smaller and smaller increments. You go around the loop with smaller increments until the goal seek criteria is met. Once you have exceeded the goal seek criteria, you go back and reduce the increment. You do this until the increment is very small and the value is found. The process of making a flexible goal seek that is flexible and changes when you change inputs is illustrated in the diagram below:

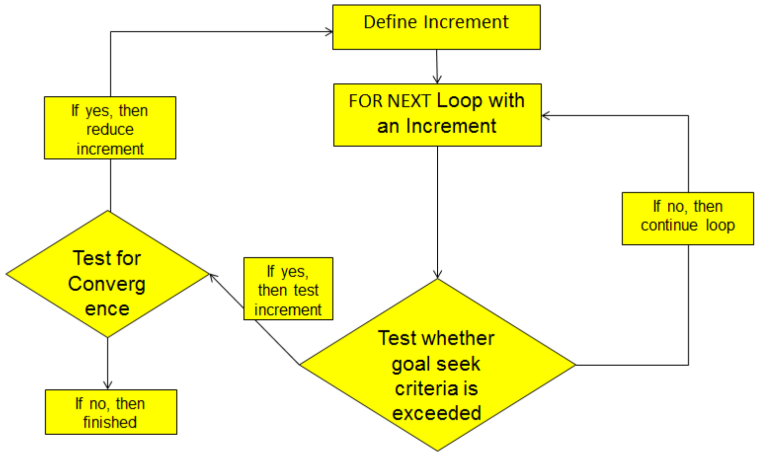


Figure 38

The function to create a flexible goal seek formula is shown below. Note that all of the formulas for computing the goal seek must be contained in the function. You cannot create such a function to replicate a goal seek with a big model to do something like find the price to meet a target IRR. Once you are finished with making the function, you can find the retirement that occurred a lifetime ago by putting in assumptions for the lifetime of plant and the growth rate.

```
'
'  This function finds the capital expenditures that were made at the beginning of the life
'  It is the automation of a goal seek function
'

Function find_base(growth, life)                            ' Backs into the percentage starting point

min_base = 0                                                ' Set inital low value for testing
max_base = 1                                                ' set the cap for testing

new_increment:                                              ' after exceeded test, come back to this point

    increment = (max_base - min_base) / 10                  ' Re-compute Increment

    For base = min_base To max_base Step increment          ' loop around smaller and smaller increment for base

        plant = base                                        ' Try different values for base
        total_plant = plant                                 ' This is the integral of the plant. You are aiming for 1

        For i = 1 To life - 1                               ' Go around life to compute the total -- you are aiming for 1.0
            plant = plant * (1 + growth)                    ' Increase the plant by the growth rate
            total_plant = total_plant + plant               ' Add the plant together (integrate)
        Next i

        If total_plant > 1 Then                             ' When base is too high go back and try again; if not, continue
            min_base = base - increment                     ' Find a smaller starting point
            max_base = base + increment
            GoTo new_increment
        End If

        If Abs(total_plant - 1) < 0.0000000001 Then          ' Test for convergence
            find_base = base
            Exit Function
        End If

    Next base                                                ' Loop over base

End Function
```

Figure 39

After you have the retirements on existing expenditures, you can complete a theoretical model that lasts for hundreds of years with changing growth rates. The model needs to continually look backwards to find capital expenditures from the prior life cycles that affect the current levels of capital expenditures.

Alternative Methods for Deriving Retirements Associated with Existing Assets in a Corporate Model

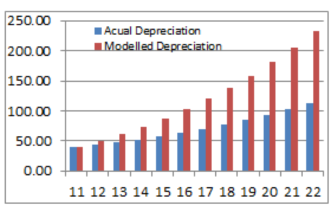
For a single asset with no terminal value, straight line depreciation is simply the gross amount spent on an asset divided by the plant life. Given this fact, one approach to computing depreciation expense is to keep track of the balance of the gross plant (i.e. without deductions for accumulated depreciation) from a table beginning with existing plant and adding capital expenditures. As explained earlier, the gross plant can be set to actual gross plant during the historic period and computed as the opening balance plus the capital expenditures in the projection period using a historic switch. Gross plant balance can then be multiplied by the depreciation rate to establish projected depreciation. The problem with this method is that it does not account for any retirements associated with existing plant. By ignoring retirements, the method overstates depreciation expense and it can lead to underestimation of taxes. Cash flow is overstated because gross plant never declines as assets are retired. The problem is worse when the asset life is short and when the projected growth rate is slow. When the asset life is short, there should be a lot of retirements on exiting plant that are ignored and when the growth rate is slow, the retirements approach 100% of depreciation.

The excerpt below demonstrates that when the growth rate is 5% and the asset life is 5 years, the overstatement of depreciation approaches 100% after a few years. The comparison between modelled depreciation and true depreciation is derived from the theoretical computation of depreciation discussed in the prior section. If the growth rate is constant, the ratios of accumulated depreciation to net plant, depreciation to net plant and capital expenditures to depreciation remain stable.

Periods	Period	Growth
Historic Period	10	7%
Modelled Period	12	10%
Long-term Period		10%
Asset Life	5.00	

Capital Ratios	Historic	Modelled	Long-term
Accumulated Depreciation to Net Plant	38.25%	36.35%	36.20%
Net Plant Depreciation Rate	32.42%	31.53%	31.35%
Gross Plant Depreciation Rate	20.00%	20.00%	20.00%
Capital Expenditures to Depreciation	121.95%	132.93%	131.90%
Retirements as Percent of Depreciation	86.95%	82.93%	81.90%
Retirements as Percent of Gross Plant	16.25%	15.08%	14.89%
Retirements as Percent of Net Plant	26.32%	23.69%	23.34%

Method 1: Gross Plant



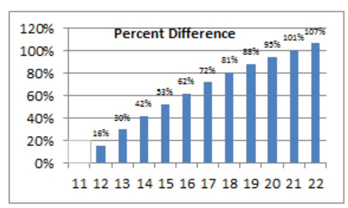


Figure 40

A second approach sometimes used is to separate the depreciation on existing assets from the depreciation on new assets. A separate schedule for the depreciation on new assets is computed using the vintage method described above. The depreciation on existing assets can either simply continue the existing level of depreciation or decline to account for retirements. The existing depreciation should also account for the capital expenditures made in the final historic year. If the existing level of depreciation does not reflect retirements and the lifetime of new assets is fairly long, the method is not very different than the above method. In this case there are no retirements of new assets or existing assets in the analysis and the depreciation is overstated. If retirements on existing assets are accounted for, some kind of retirement statistic must be entered and then the accumulated retirements should be calculated. Once the accumulated retirements are tabulated, the adjustment to existing depreciation can be computed as the accumulated amount multiplied by a depreciation rate. Further, a MIN test should be included so that the depreciation on the retirements do not exceed the existing depreciation expense.

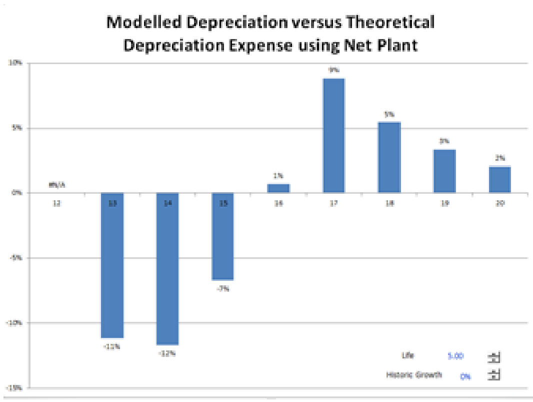
This approach to depreciation expense is illustrated in the excerpt below. When these adjustments are made, the depreciation expense is more accurate. The problem with this method is that it is a bit tedious to implement and one needs information on historic growth and the retirements as a percent of deprecation expense.

Period	Test	Growth	0	10	11	12	13	14	15	16	17	18
Historic Period	11	5%		TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Modelled Period	9	5%		FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Long-term Period	280	0%		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Test	TRUE			TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Simulated Depreciation Method TWO - Existing Depreicaiton Flat and New De												
Existing Depreciation				0.00	34.21	34.21	34.21	34.21	34.21	34.21	34.21	34.21
Retirements to Deprecaiation				0.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Retirements				0.00	30.95	30.95	30.95	30.95	30.95	30.95	30.95	30.95
Accumulated Retirements				FALSE	FALSE	30.95	61.91	92.86	123.81	154.76	185.72	216.67
Depreciation on Retirements				0.00	0.00	0.00	6.19	12.38	18.57	24.76	30.95	34.21
New Plant Balance												
Opening Balance				0.00	0.00	0.00	39.50	80.98	124.54	170.27	218.29	229.20
Add: Captial Expenditures				FALSE	FALSE	39.50	41.48	43.55	45.73	48.02	50.42	52.94
Less: Retirements				FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	39.50	41.48
Closing Balance				0.00	0.00	39.50	80.98	124.54	170.27	218.29	229.20	240.66
Deprecaiton Rate				0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Deprecation Expense				0.00	0.00	0.00	7.90	16.20	24.91	34.05	43.66	45.84
Total Modelled Deprecation				0.00	34.21	34.21	35.92	38.02	40.54	43.50	46.91	45.84

Figure 41

To approximate retirements, some modellers project depreciation on existing assets using the net plant balance multiplied by the net plant depreciation rate and separately compute the depreciation on new assets. As the balance of net plant declines each period, the depreciation expense also declines implying that retirement of assets for existing assets is implicitly reflected in the forecast. If this net plant method is used, one must make sure that the net plant balance does not become negative. Although this approach of splitting-up depreciation does indirectly account for retirements, it is not an accurate reflection of retirements unless the rate of retirement for existing assets (relative to net plant) is the same as the net plant depreciation rate. The approach assumes that if the net plant depreciation rate is 15%, then the implicit retirement rate percentage of existing assets is also 15%. Unless the growth rate for the historic period is zero, there is no basis for making this assumption. Another problem with this approach is that, the depreciation rate on net plant does not remain constant over the lifetime of existing assets. If the retirements are less than depreciation, then the depreciation rate on net plant will increase as the net plant balance declines. Over the lifetime of a single asset, the ratio of depreciation expense to net plant – the gross plant less the accumulated depreciation expense – declines as depreciation remains constant but net plant reduces. For a corporation with many assets, multiplying net plant by a constant depreciation rate can also result in biased forecasts because the depreciation rate on net plant is affected by the growth rate of the company and when growth rate changes, the depreciation rate on net plant also changes.

The pattern of errors from applying the net plant method is illustrated below for cases with different growth and different plant lives. The left panel demonstrates the method understates depreciation in early years, but overstates depreciation in later years with a short life and a low growth rate. The right panel shows the depreciation is consistently understated using the second method. Where depreciation is understated, the cash flow is understated and the income is overstated. If you are using the formula NOPLAT x (1-g/ROIC)/(WACC-g) then the understatement in depreciation results in an understatement of terminal value. Finally, note that the error in computing depreciation is less using the net plant method than the error from ignoring retirements.



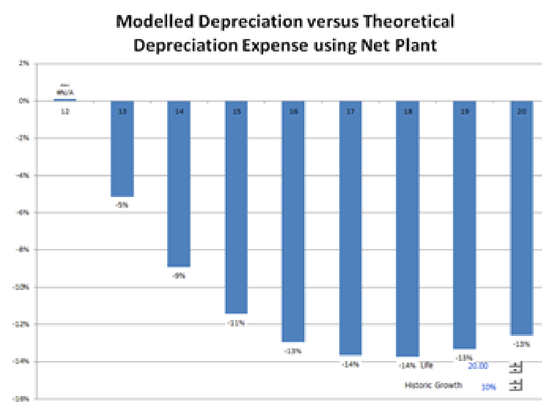


Figure 42

The third method introduced is to directly model the retirements using the historic growth rate and to separately model the new assets using a vintage approach. Application of this method requires two user defined functions and computing retirements associated with the existing assets. With the two functions and information regularly reported on the financial statements you quickly make the more accurate calculation. To make a more accurate calculation of depreciation on existing assets from the theoretical retirements you can follow the following step by step process:

Step 1: Find the ratio of the accumulated depreciation to net plant from the historic financials

Step 2: Compute the ***implied historic growth*** from the accumulated depreciation to net plant by making a user defined function. This function is similar to the function discussed above to find the base level of retirements. If is a function that does the same thing as a goal seek on a dynamic basis. You start with a loop from -100% growth to 100% growth and step around by 1%. Then you compute the ratio of accumulated depreciation to plant. Once the target ratio has been found, you make a smaller increment than 1% and make another loop. You repeat the process until the computed ratio of accumulated depreciation to plant just equals your target level.

Step 3: Compute the ***base retirements*** as a percent of gross plant by using the base retirement function defined above. Recall that this function accepts the growth rate and the plant life, both of which have now been determined.

Step 4: Compute retirements of the existing plant over the projected period. This can be accomplished by making a switch for the first modelled period. In this period the retirements are the opening plant balance multiplied by the base retirements established above. For subsequent periods, the retirements are the prior value of retirements multiplied by the growth rate computed in step 2. The formula for retirements is:

Existing Retirements = IF(First Modelled Period, Opening Gross Plant x Base, Prior Value x (1+Growth))

Step 5: Compute the balance of plant, the depreciation on existing plant and the depreciation on new plant.

An example of this process for computing the depreciation is demonstrated below.

	D	E	F	G	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1	**Timing**														
2	Period	Test	Growth	0	15	16	17	18	19	20	21	22	23	24	25
3	Historic Period	16	7%		TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
4	Modelled Period	17	10%		FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
5	Long-term Period	267	10%		FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
6	Test	TRUE			TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
7	Last Historic Period				FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
8	First Modelled Period				FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
132	**Depreciation Method FOUR using Functions**														
133	Parameters														
134	Life	12.00													
135	Accumulated Depreciation From History	39.18%													
136	Implied Historic Growth	7.01%	< ---- =find_growth(E135,E134)												
137	Base Retirements	5.59%	< ---- =find_base(E136,E134)												
138															
139	Existing Deprecation														
140	Opening Balance	=G142---->			257.85	275.90	295.22	278.72	261.07	242.18	221.96	200.33	177.19	152.42	125.92
141	Less: Retirements	=MIN(IF(H8,H140*$E$137,G141*(1+$E$136)),H140)-			0.00	0.00	16.50	17.65	18.89	20.21	21.63	23.14	24.77	26.50	28.36
142	Closing Balance	=IF(H3,H37,H140-H141)---->			275.90	295.22	278.72	261.07	242.18	221.96	200.33	177.19	152.42	125.92	97.56
143															
144	Deprecation on Existing Plant	=H140*(1/$E$134)*H4---->			0.00	0.00	24.60	23.23	21.76	20.18	18.50	16.69	14.77	12.70	10.49
145															
146	New Depreciation														
147	Opening Balance	=G150---->			0.00	0.00	0.00	46.02	96.16	150.77	210.28	275.14	345.83	422.90	506.93
148	Add: New Captial Expenditures	=IF(H4,H25)---->			FALSE	FALSE	46.02	50.13	54.62	59.51	64.85	70.69	77.07	84.03	91.64
149	Less: Retirements on New Plant	=IF(H2>=$E$134,OFFSET(H148,0,-$E$134))---->			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
150	Closing Balance	=H147+H148-H149---->			0.00	0.00	46.02	96.16	150.77	210.28	275.14	345.83	422.90	506.93	598.56
151															
152	Depreciation on New Plant	=H147*(1/$E$134)---->			0.00	0.00	0.00	3.84	8.01	12.56	17.52	22.93	28.82	35.24	42.24
153	Total Modelled Depreciation	=H152+H144---->			0.00	0.00	24.60	27.06	29.77	32.75	36.02	39.62	43.58	47.94	52.74
154															
155	Theoretical Depreciation				21.49	22.99	24.60	27.06	29.77	32.74	36.02	39.62	43.58	47.94	52.74

Figure 43

If the historic growth rate is not constant, computing the implied growth from the accumulated depreciation ratio may not be precise and assuming the retirements follow a constant growth rate will not be perfect. However, an experiment with random growth demonstrates that the error is very small.

Depreciation Issues in Project Finance Models

In a project finance model, depreciation should be computed through establishing a gross plant balance account which increases with the construction costs over the construction period. To begin the depreciation at commencement of operation, the tax depreciation rate (which may vary with the age of the project) is multiplied by the balance of the plant as well as operating switch. As with the non-project finance models, the accumulated depreciation should be computed after the depreciation expense row. Computing depreciation can be complicated in a project finance model because of the manner in which tax depreciation is driven by the calendar year rather than the date the project begins operation. If the operation date is 27 December, the depreciation is the same as if the operation date is 5 January meaning it is much better to put the plant in service at the end of the calendar year. To resolve this problem, the number of calendar months in the year should be computed and the calendar year must be computed. Some techniques to accomplish this include:

1. Compute a switch for a new calendar year by making a test when the month of the start date is greater than the month of the end date using the MONTH function.
2. Use the switch to make a counter for the calendar year through accumulating the switch
3. Make an adjustment for the first operating year for which the counter should begin (you have to also make an adjustment so that you do not double count).
4. Use the COUNTIF function using both the range and the criteria as the annual year to find the number of periods per year.
5. The depreciation rate for the period is 1/life divided by the periods per year.

Modelling the Change in Deferred Taxes in Corporate Models

In making a corporate model, the measuring cash flow is one of the primary objectives. When evaluating cash flow, the taxes actually paid must be computed rather than the taxes booked. The taxes paid can be approximated by adding the change in deferred tax to taxes booked as illustrated by the formula below. This implies that you should compute deferred taxes in a model. Deferred taxes associated with tax loss carry forwards are computed a subsequent chapter discussing the profit and loss statement and deferred taxes associated with financing items such as fair valuation of derivatives are discussed in Part

3. This section explains how you deal with the painful issue of deferred taxes other than simply pretending that deferred taxes simply do not exist or that the change in deferred tax will always be zero.

Taxes Paid = Taxes Booked - Change in Deferred Tax Liability

The approach for computing changes in deferred tax related to capital expenditures and depreciation logically follows the mechanics of calculating deprecation. As with calculation of depreciation, it is convenient to separate the change in deferred tax between amounts associated with existing assets and amounts associated with new assets. For the new assets, tax depreciation can be computed once you know the tax depreciation life and the tax depreciation method. The vintage approach discussed above (incorporating accelerated depreciation methods for tax depreciation is often more relevant than for tax deprecation). With the tax depreciation computed, the change in deferred tax liability associated with new assets is simply the tax depreciation less the book depreciation multiplied by the tax rate:

Change in Deferred Tax Liability = (Tax Depreciation - Book Depreciation) x Tax Rate

As with book depreciation, finding the change in deferred tax associated with existing assets is more difficult than computing deferred taxes associated with new assets. As the gross plant balance from the last historic year had to somehow spread across future years, the accumulated deferred tax associated with accelerated depreciation must also be determined. In the case of deferred tax, the manner in which the liability will reverse (representing a change in deferred tax) depends on how the deferred tax originally arose. You could use the find_base function described above; you could simply spread the deferred taxes over the remaining life on a straight line basis or you could come up with some other approach.

Adjusting the Tax Basis in an Acquisition

For tax purposes, an acquisition can be treated as a purchase of assets or a purchase of shares of stock. This tax treatment must be distinguished from the book accounting for an acquisition which results in re-valuation of assets and re-establishing the equity. If the acquisition involves a purchase of assets of assets rather than the purchase of stock for tax purposes, the acquisition price should be have a higher value as the asset base will be higher and the value of depreciation deductions increase. In evaluating an acquisition, comparative multiples should account for the difference in value from purchase of stock versus purchase of assets as the multiples should account for the difference in tax rates for different countries.

If the acquisition is a stock transaction, no write-up for tax purposes occurs, the seller does not pay tax on gain realized from selling asset and the buyer can use the existing net operating loss. For an asset purchase the tax depreciation deductions take place over an extended period while the taxable gain must be paid immediately by the seller. Therefore, from the perspective of both the acquiring company and the target company on a combined basis, a stock transaction generally has a positive outcome because the gain on the sale is taxable as current income while the write-up is deducted on a periodic basis. On a present value basis, the government treasury wins and the combined shareholders of the two companies lose if the transaction is classified as an asset purchase. In situations with net operating loss, the situation is even worse as the value of the net operating loss carry-forward is lost.

To establish the tax and book depreciation expense in alternative transaction structures, the following steps can facilitate the development of a model:

1. The existing deferred taxes can be used to derive the existing difference between the tax and book base through dividing the accumulated deferred tax related to depreciation by the income tax rate.

   Existing Basis Difference = Accumulated Deferred Tax/Income Tax Rate

2. In a stock transaction, the valuation of the assets increases for books, but the tax basis does not change. The difference in the basis increases the balance of accumulated deferred tax as demonstrated in the formula below.

   Accumulated Deferred Tax after Transaction =
   (New Book Basis – Existing Basis) x Income Tax Rate

3. When computing the goodwill for developing the pro-forma balance sheet, the increase in assets as well as the increase of accumulated deferred tax must be accounted for. In addition to other goodwill adjustments, the goodwill formula should include:

   Goodwill = Goodwill – Increase in Asset Valuation – Increase in Accumulated Deferred Tax

Chapter 9: Adding Debt to a Corporate or Project Finance Model and How to Program Cash Flow Waterfalls that Define Who Receives Cash First and Where the Cash Flow Ultimately Goes

Once free cash flow has been established in a model, one can think of the remaining task as allocating the cash flow and earnings among different investors. Some cash flow is distributed to the debt investors and some is left for equity investors. Depending on the financial structure of the company, there may be multiple tranches and allocations within both the debt and equity securities. While much of the time spent in financial modelling should be involve analysing value drivers, it is also important to accurately reflect the financial structure so and the claims on the free cash flow. Mechanical programming issues that arise from translating free cash flow into effective analysis of the risk and value of debt and equity value discussed in much of the remainder of this part of the book. This chapter addresses various modelling issues that arise when incorporating debt into a corporate, project finance, acquisition or merger model. The amount of debt that can be issued and maintained on the balance sheet is central to the general idea of using the risk analysis process of lenders to derive value of an investment which is central to many of the ideas presented in this text. Furthermore, the risk to lenders relative to the earned credit spread is also a critical subject in finance.

Given the importance of evaluating risks faced by lenders, reflecting the specific features of debt is an essential part of the modelling process. These features include (1) the size of debt; (2) the repayment structure of the debt; (3) interest rates and fees paid on the debt while it is outstanding; and, (4) credit enhancements including covenants and required debt service reserves. The amount of debt issued in leveraged buyouts and project financed transactions (the first item) is a key driver of equity returns and whether the investment takes place. The structure of debt repayments, new debt issues (the second item) is related to the size of the debt and can be the item that consumes most time in working with lenders. The base interest rate and the credit spreads (the third item) relative to the project IRR is the reason debt increases returns to equity holders. Depending on the transaction, the covenants and credit spreads (the fourth item) may be a function of financial ratios such as the debt service coverage or the ratio of debt to EBITDA and be a big driver of equity returns and lender risk. Debt structuring is also important in corporate models and merger integration models as the amount of debt issued in a merger can be an important driver of the accretion or dilution in earnings per share.

Adding a Debt Schedule to a Corporate Model or a Project Finance Model after Free Cash Flow has been Established

The fundamental part of adding debt to any model is to define a debt schedule that includes the balance of debt outstanding and the interest expense from the balance of the debt. The debt outstanding should be structured by explicitly showing the opening balance, the new debt issues, the debt repayments and the closing balance on separate rows of the model. Debt balance schedules should be listed for each existing and prospective debt facility that will be present during the forecast horizon. For corporate

models, the debt schedule should include all of the debt issues that are outstanding as of the last balance sheet date plus any new issues that may occur over the forecast period. In the case of project finance models, the debt issues include all of the different tranches of debt that are issued to finance construction as well as facilities for letters of credit, potential for defaults, and reserve accounts that are like negative debt. Acquisition models generally include debt issues that are used in financing the acquisition as well as debt that was issued prior to the acquisition and that will be assumed by the new owners.

The starting point for the debt schedule that establishes the closing balance differs depending on the type of model. When developing corporate models, the closing balance of each debt balance is launched from the financial inputs that should list the amount outstanding in the base balance sheet year for each debt issue. The sum of these individual issues should correspond to the total amount of long-term debt on the balance sheet (including current maturities of short term debt.) If the sum of the closing balance of all of the debt issues does not equal the balance sheet amount, the prospective balance sheet will not balance and there will be an inconsistency in debt maturities and interest expense with actual financial obligations. Therefore, a verification check to assure that the total debt on the balance sheet equals the sum of the individual debt issues can be effective in verifying the model. The process of adding a debt schedule to a corporate model includes the following:

- Set-up the debt schedule with separate lines for:
  - The opening balance
  - Additions from new issues
  - Subtractions from debt repayments
  - The closing balance

- For corporate models, the total closing balance in historic years should be derived from the balance sheet

- The opening balance is equal to the closing balance in the prior period

Once the opening and closing balance are established, the interest cost (whether capitalized or expensed) can be computed. For models that include capitalised interest or a cash flow sweep, it is convenient and sometimes essential to assume that repayments occur at the end of the period which means the opening balance is the basis of accrued interest. If the repayment occurs at the end of the period (say the payments to construction expenditures are made at the end of the month), then there is no accrued interest on borrowings related to the expenditures. Here, where everything occurs at the end of the period, the accrued interest is computed on the debt that was outstanding before the new debt was issued or repaid in the current period, which implies that the basis of interest expense is the opening balance. Unless the opening balance is used, hopeless circularity will arise. This idea of using the opening balance is consistent with actual payments of interest and is the primary reason periodic models are used rather than annual models. If the repayment occurs at the beginning of the period, the interest expense is computed on the closing balance. If the repayment occurs somewhere between the beginning and end of the period, the interest is a weighted average of the opening and closing balance.

Modelling Scheduled Debt Repayments

The manner of repaying debt depends on the type of debt issue and the type of the model. Repayments may range from complex debt sculpting to relatively simple equal instalments. For some models, computing the debt repayment is the most complex element of the modelling process. Given the importance and the difficulty in computing debt repayments in project finance models, much of the discussion in Part 4 addresses mechanical aspects of debt repayment and associated circularity in detail. In non-project finance models, the repayment calculation can often be derived from the opening balance of the debt at the beginning of the forecast period. For a corporate model where debt issues may be repaid on a single date or bullet repayments, a simple test can be created from the debt repayment year to assure that repayment only occurs on a single date. This involves the following few steps:

- Add a line for the repayment of the debt after the opening balance

- Create a formula that compares the model year with the repayment year to create a logical variable (year = repayment year)

- Multiply the switch (year = repayment year) by the opening balance of the debt

The manner of debt repayment in a project finance model or a leveraged finance model is often designed to correspond to the expected cash flows generated by the investment. Repayments can be structured with percentages that are applied to the aggregate amount of debt issued rather than the closing or opening balance. This means it is a good idea to show the total accumulated amount of the debt issued on a separate line item above the debt balance (this amount does not decline over time). The accumulated debt issued can then be multiplied by the repayment percent or a tailored repayment schedule to establish the periodic repayments.

Because of early debt repayments that can occur if covenants or cash sweeps are triggered, you should make sure that the amounts in the repayment line of a debt schedule do not exceed the amount of debt outstanding. To program this, the MIN function can be used as illustrated below. For leveraged acquisition models and/or integrated merger models, a combination of the corporate finance and the project finance approaches can be applied depending on the type of debt used to finance the acquisition.

Repayment = MIN(scheduled repayment, opening balance)

One of the most important audit tests in a model is that the debt balance is zero after the repayment period. You can design this test with the SUMIF function along with the repayment switch as follows.

Debt Test: SUMIF(Repayment Switch, FALSE, Opening Debt Balance) = 0

Connecting Debt to Cash Flow in Corporate Model and Circularity Created by Interest Expense

In corporate models it is useful to set up a cash account and some kind of new debt account after computing free cash flow. This account can be used to make the cash flow connect with the debt and cash balance if the net cash flow from the cash flow is the change in the balance. The net cash account is a lot like other debt accounts with opening and closing balances except that it begins with the cash minus the short-term debt on the historic balance sheet. Unlike other accounts, the cash less debt amount is incremented with net cash flow on the balance sheet. To illustrate how this account works assume there is a negative net balance on in the last historic year because of more short-term debt than surplus cash. If the net cash flow on the cash flow statement after all other everything is accounted for is positive by more than the opening balance, then the cash is assumed to be used to pay-off the short-term debt and then build up in surplus balances. If the net cash less short-term debt account is positive, surplus cash is placed on the balance sheet. If the account is negative, then the negative amount represents debt. This means the net cash and new debt account should be split between cash and debt. To make this presentation, after the net balance has been established, the amount can be allocated to cash or short-term debt using the MAX function as illustrated below:

Surplus Cash = MAX(Cash net of debt balance, 0)

Short-term Debt Balance = MAX(-Cash net of debt balance, 0)

In many models, a problem of circularity arises because interest expense drives cash flow, but the debt balance or the interest expense is affected by cash flow itself. When the assumption is made that interest expense cannot be computed on the opening balance, then the interest expense affects cash flow, but the cash flow affects the debt balance and interest expense. The most common circularity problem in corporate models comes from the assumption that cash flows and therefore interest expenses occur in the middle of the year. If monthly or even a daily model were constructed, the circularity would not arise because interest is paid on the opening balance of the debt and cash flow does not affect the opening

balance. As with most circular references, the problem arises because of an artifact of the financial model – in the real world bankers do not require interest expense to be paid using a circular formula where they first compute interest expense and then re-compute the interest expense because the debt is increased by interest expense.

With A Few Steps You Can Model Any Cash Flow Waterfall

Any time debt is issued to finance capital expenditures and other items of a corporation, the uses of funds in a project financing or the purchase of a company, a loan agreement defines various restrictions on uses of cash to pay dividends, subordinated debt and other items. The manner in which a loan agreement establishes priorities in the use of cash flow is sometimes called a cash flow waterfall. A cash flow waterfall is somewhat analogous to multiple hydro plants in a cascade where water is held in reservoirs and allowed to flow down-stream by opening or closing various taps. If reservoirs are full, then the water can be allowed to flow down-stream. On the other hand, if reservoirs are empty, there may be requirements to fill-up the reservoir before any water can be used by subsequent hydro plants in the cascade. A cash flow waterfall that defines the priority of uses of cash is illustrated in the diagram below. For project finance models and acquisition models, modelling the mechanics of cashflow waterfalls that include cash flow sweeps, use and repayment of revolving credit facilities, cash trap covenants, top-ups and with-drawls from a debt service reserve accounts, debt defaults and repayment of defaults as well as interest and repayment of subordinated debt can be intimidating to model, much less analyse in a clear and concise manner.

Figure 44

In setting up a cash flow waterfall, you can apply a few ideas and make a seemingly complex waterfall easy to program in a financial model. The general ideas include: (1) setting up the debt schedule (including debt service reserve accounts); (2) structuring the cash flow statement with a whole lot of subtotals; (3) separately modelling what happens if cash flow is positive versus what happens when cash flow is negative using the MAX function; and (4) assuring that you have not exceeded defined limits of debt or reserves using the MIN statement relative to the opening balance or the remaining allowed balance. Application of these four steps includes:

- ❖ First, type in account titles for the debt schedule and reserve balance schedule with opening balances, prepayments from sweeps, uses of revolving credit, repayments and availability,

required balances uses and top-ups of debt service reserve accounts. Do not type in excel formulas until all of the cash flow statement is structured.

- For each item such as cash flow sweeps, defaulted debt, repayment of defaulted debt that comes from the cash flow statement, leave the amount in the debt schedule blank and just enter the title. Amounts from the cash flow statement should all be linked to the debt schedule at the end of the process meaning that all of the formulas to determine how much will be removed or placed in an account is done in the cash flow analysis. The excerpt below illustrates the set-up of a debt schedule for an acquisition model. Items in red come from the cash flow statement:

Financing- Debt schedule			
Existing Debt			
Opening Balance			
less: repayment	7.0	28	
Closing Balance			20.00
Existing Debt Test			
Periodic rate			
Interest expense			
Amortising debt			
opening balance			
less: repayment	5.0	20	
closing balance			140.00
Amortising Debt Test			
Bullet Debt			
opening balance			
less: scheduled repayment			
less: cashflow sweep			
closing balance			130.00
Capitalizing Debt			
opening balance			
add: capitalizing interest			
less: cashflow sweep			
closing balance			40.00

Revolving debt		
Total debt commitment		
less: amount borrowed		
remaining amount to borrow		
Periodic Commitment Fee	2%	0.50%
opening balance		
add: drawings		
less: repayments		
closing balance		
Defaulted debt		
opening balance		
add: defaults		
less: repayments of default		
closing balance		
Total Interest Expense		
Repayment		
Total Senior Debt Opening Balance		-
Total Senior Debt Closing Balance		290.00
Average Interest Rate		

Figure 45

- For accounts such as letters of credit and debt service accounts you can set up accounts that track the remaining amount of the commitment that can be used or the remaining funding that is required in the account. For a letter of credit, the remaining amount that is available for use is the total commitment less the amount that has already been borrowed. For a debt service reserve account, the amount that must be funded is the total required funding less the amount that is already in the account. Setting-up a letter of credit that can be used to fund deficit cash flow is illustrated below where the borrowings and the repayments come from the cash flow statement:

Total Debt Commitment
Less: Amount Already Borrowed (Opening Balance of Loan)
Remaining Amount to Borrow

Opening Balance of Loan ←
Add: Amount Borrowed: From Cash Flow Statement
Less: Amount Repaid: From Cash Flow Statement
Closing Balance

- Second, set up the cash flow account titles and the priorities of the cash flow waterfall in the model without entering any formulas.

    - In setting up titles include a whole lot of subtotals in the model design – after virtually every element, such as borrowings and paying back the working capital facility, the debt service reserve flows, the debt defaults and repayment of defaults, the cash flow sweep, and the cash trapped by the covenant. The order of priority in terms of which investor receives cash flows should be set-up in a cash flow analysis. An example of setting-up the cash flow analysis with sub-totals with a debt service reserve account, a letter of credit and defaults and a cash flow sweep is illustrated below (in a real model you would not include as much description):

      Operating Cash Flow
      Less: Interest Expense on Senior Debt
      Less: Repayments of Scheduled Debt
      Subtotal 1: Cash Flow after Scheduled Debt Repayment
      Add: With Drawls from DSRA if Cash Flow is Negative
      Less: Top-ups of DSRA if Cash Flow is Positive
      Subtotal 2: Cash Flow after DSRA
      Add: Uses of Letter of Credit if Cash Flow is Negative
      Less: Repayment of Letter of Credit if Cash Flow is Positive
      Subtotal 3: Cash Flow after Letter of Credit
      Add: Defaults on Debt if Cash Flow is Negative
      Less: Repayments if Cash Flow is Positive
      Subtotal 4: Cash Flow after Default
      Less: Cash Flow Sweep if Cash Flow is Positive

    - In setting up titles for a flip structure as discussed below, it is useful to set-up some supplemental accounts to establish the subtotals as illustrated below:

      Total Cash Flow to Investors
      Cash Flow to Senior Investors before Yield Constraint
      Less: Cash Flow to Senior Investors before Yield Constraint
      Subtotal 1: Cash Flow after Senior Investors before Yield Constraint

      Cash Flow with Yield Constraint/Cash Flow to Senior without Constraint
      Subtotal 2: Cash Flow to Senior Investors after Yield Constraint
      Less: Cash Flow to Senior Investors after Yield Constraint (1-percent) x Total Cash
      Subtotal 3: Cash Flow to Junior Investors

- Third, enter formulas for each step of the cash flow waterfall differently depending on whether the cash flow is positive or negative using a combination of the MAX and MIN functions. As you get used to using the MIN and the MAX functions, you will forget any idea about using IF statements that make the formulas less transparent.

    - Use the MAX(cash flow,0) function to test for positive numbers and use the MAX(-cash flow,0) to test negative numbers. For example, if the cash flow after senior debt service is negative, then you should draw from the revolving credit account and use MAX(-number,0) while if it is positive you should use available cash to repay balances and apply the MAX(number,0) function.

❖ Fourth, in determining how much cash is available or must be used to pay back items, use the MIN function and test the amount against the opening balance.

- Virtually all of the calculations in the cash flow waterfall will include both a MIN and a MAX function, but this does not mean that the formulas are too complex. For example, when modelling the amount of cash flow that is borrowed from the letter of credit account, the formula should look something like:
  - MIN(opening balance of available to borrow, MAX(-cash flow,0))
- If cash flow is positive, then the second component of the formula is zero and the minimum of zero or the balance available will be zero. When the cash flow is positive, then the positive cash flow can be used to repay amounts in the working capital facility as shown in the formula below -- if the opening balance is paid off, then the formula will result in zero as it will if the cash flow is negative:
  - MIN(opening balance of revolving debt, MAX(cash flow,0))
- In modelling a flip structure, use the MIN command to compare the opening balance of the yield tracking account and the cash flow that would accrue to the senior investors if there was no constraint on the yield. The MIN function combined with the tracking account can be used to find the time at which the yield is realized.
  - MIN(Opening balance of tracking account, cash flow)

❖ Fifth, link accounts in the cash flow waterfall to the debt schedule meaning that all formulas with MIN and MAX are in the cash flow portion of the model.

- In attaching accounts, the formulas in the debt schedule should be all be simple links, as the evaluations with MAX and MIN formulas have been made in the cash flow analysis. The rule is to keep the formulas in the debt schedule extremely simple. The excerpt below illustrates how the cash flow waterfall is a collection of MIN and MAX functions and sub-totals.

	A B C D	F	G	K	L	AA	AB	AC	AD	AE
1	Timings									
2										
3	Date		01-oct-15	01-oct-16	01-janv-17	01-oct-20	01-janv-21	01-avr-21	01-juil-21	01-oct-21
4	Cash flow date		01-oct-15	16-août-16	16-nov-16	16-août-20	16-nov-20	15-févr-21	16-mai-21	16-août-21
5	Holding period			TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
6	Exit period			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
202	Operating cash flow			15.35	14.87	25.99	26.38	26.49	27.45	27.92
203	Less: CAPEX			7.75	7.81	6.38	6.46	6.54	6.62	6.70
204	Add: exit proceeds			-	-	-	-	-	-	-
205	Add: Notes Receivable			2.93	2.93	2.93	2.93	2.93	2.93	2.93
206	Less: Pensions			-	-	-	-	-	-	-
207	Less: Commitment Fee			0.22	0.22	0.22	0.22	0.22	0.22	0.22
208	Cashflow before financing	=H202-H203+H204+H205-H206-H207---->		10.31	9.76	22.31	22.62	22.66	23.53	23.92
209	less: senior repayments			7.71	7.71	7.71	0.71	0.71	0.71	0.71
210	less: senior interest			2.37	2.30	0.15	0.04	0.03	0.02	0.02
211	Cashflow after senior debt service	=H208-H209-H210---->		0.22 -	0.25	14.44	21.87	21.92	22.80	23.19
212	add: draws on revolver	=MIN(MAX(-H211,0),H148)---->		-	0.25	-	-	-	-	-
213	less: repayments of revolver	=MIN(MAX(H211,0),H152)---->		0.09	-	-	-	-	-	-
214	Cashflow after revolver	=H211+H212-H213---->		0.13	-	14.44	21.87	21.92	22.80	23.19
215	less: repayment of default	=MIN(MAX(H214,0),H165)---->		-	-	-	-	-	-	-
216	Cashflow after repayment of default	=H214-H215---->		0.13	-	14.44	21.87	21.92	22.80	23.19
217	less: cashflow sweeps	=MIN(MAX(H216,0),H119-H120)---->		0.13	-	14.44	1.58	-	-	-
218	Cashflow after sweep	=H216-H217---->		-	-	-	20.29	21.92	22.80	23.19
219	add: default on senior debt	=MAX(-H218,0)---->		-	-	-	-	-	-	-
220	cashflow after senior debt	=H218+H219---->		-	-	-	20.29	21.92	22.80	23.19
221	less: repayments of the sub-debt	=MIN(MAX(H220,0),H132+H133)---->		-	-	-	20.29	21.92	19.95	-
222	Cashflow to equity	=H220-H221---->		-	-	-	-	-	2.85	23.19

Figure 46

Defaults on Debt and Measuring the Potential Decline in Debt IRR below the Stated Interest Rate

In using a model to assess an investment with debt financing, a useful task is to determine at what point a loss on the loan occurs. When a loss on debt occurs, the interest rate or the IRR realized by lenders is less than promised interest rate and attempts to restructure the debt have not allowed temporary defaults to be repaid. Modelling the point at which defaults on debt occur is useful in credit analysis because one of the objectives of credit analysis is to measure the probability of default as well as the loss given default relative to the credit spread that compensates for risk. Through explicitly modelling defaults, one can analyse at what point the cash flow is insufficient to repay the debt after restructuring. The IRR earned on debt can be computed in a similar manner to the equity IRR where cash outflows made by equity holders are compared to the dividends received in the pockets of the equity holders. In the case of the debt IRR one can measure the cash flow dispersed to lenders and then the debt service received by lenders. Once the realized IRR on debt is computed through accounting for defaults, the risk of debt can be evaluated through break-even analysis, scenario analysis and Monte Carlo simulation. For example, by incorporating defaults on debt in a model, the break-even level of EBITDA can be computed. The probability of achieving this break-even level of EBITDA can then be used to assess the credit spread of the loan.

The process of incorporating defaults into a financial model involves linking the cash flow statement with the debt schedule using the cash flow waterfall concepts discussed above. The amount of defaults is determined in the cash flow statement using a subtotal account. The amount of default that can be repaid is calculated if there is an opening balance in the default account and if the cash flow after other obligations is positive. The following step by step process can works through how to compute the defaults:

Step1: Set up the a debt balance schedule for the defaulted debt with line items that include the opening balance of defaulted debt, the additions to the defaulted balance from defaults, the repayments of default from positive cash flow and the ending balance of defaulted debt.

Step 2: Compute a sub-total cash flow account after the scheduled debt is paid and after all possible other contingent accounts have been used including the debt service reserve accounts, letters of credit and working capital facilities. Compute the defaults in a row below this sub-total when the amount in the sub-total is negative implying that there is an inability to meet debt service. The amount of the default is limited to the amount of debt service that is assumed to be paid and can be computed using the formula MAX(-cash flow,0) along with a MIN function that limits the default to the total debt service. The following formula represents computation of the defaults on debt:

Default = MIN(debt service, MAX(-cash flow,0)

Step 3: Link the defaults in debt to the defaulted debt schedule. As for other items in the cash flow waterfall such as the debt service reserve account and letters of credit, calculations of cash flow movements should be made in the cash flow statement where they can be directly to subtotals and the only formula in the defaulted debt schedule should be a link.

Step 4: Below the debt defaulted row in the cash flow statement, set-up as line for the re-payment of default. The repayment of default is a function of the cash flow and the amount of debt default. Repayment of cash flow only occurs when the cash flow is positive meaning an MAX function should be used. The repayment of default cannot be above the total amount of the defaulted which means it should be capped by the opening balance of the defaulted debt. This means the defaulted debt is the minimum of the positive cash flow or the opening balance of the defaulted debt as shown in the formula below. Once the repayment of the default is computed in the cash flow waterfall using the formula above, link the repayment of default to the debt schedule.

MIN(opening balance of defaulted debt, MAX(cash flow,0))

Step 5: Compute the cash flow realized by lenders for purpose of computing the debt IRR and the debt NPV through deducting defaults and adding re-payment of defaults to the scheduled debt service. The debt cash flow is demonstrated in the following formula:

Debt cash flow = Interest paid + repayments – defaults + repayment of default – cash debt invested

A diagram that is intended to illustrate the link between the cash flow statement and the debt balance is presented below. The diagram below illustrates that the default comes from the cash flow statement, the repayment of default comes from the earlier default, and the repayment of default is put back into the cash flow statement.

Including Subordinated Debt with the Ability to Assess Risk and Return Characteristics of Subordinated Debt Relative to Senior Debt

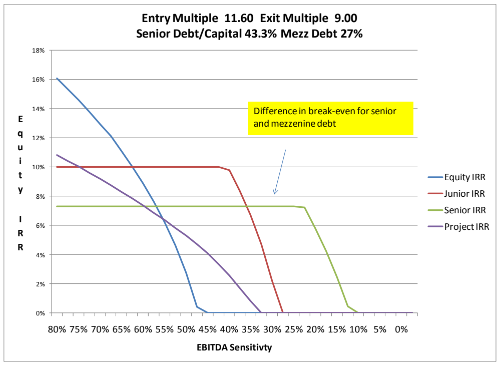
The most basic issue in finance is assessing risks relative to returns from an investment. The issue of risk and return is highlighted in analysis of subordinated debt where the higher credit spread on subordinated debt must be evaluated relative to the higher risk of subordinated debt relative to senior debt. To evaluate the risk of subordinated debt, a financial model much be able to determine the point at which the loss occurs and the risk and return characteristics of the subordinated debt. In modelling subordinated debt, the first step is to include the debt in the sources and uses analysis. When developing the subordinated debt schedule, it is possible that interest is capitalized and added to the balance of the debt. If interest is capitalised, then in the final period when the subordinated debt matures, the amount of the debt repayment is the sum of the opening debt balance and the interest capitalized for the final year.

Once the debt schedule is established for subordinated debt, the cash flow statement must reflect the priority of the subordinated debt relative to other debt service. If debt with differing priority is included in the cash flow statement, then a cash flow waterfall should be modelled that reflects the specific provisions including the interest, repayment of debt service, covenants and sweeps of the alternative debt. When structuring the cash flow statement with alternative priorities, it is essential that the ordering of titles in the cash flow analysis conform the priority of cash flow claims in the loan documents. For example, if there is a cash flow sweep for senior debt and junior debt interest is not capitalized, then the senior debt sweep must occur after the junior debt interest payments.

To illustrate how a model can be used to assess the risk of senior versus subordinated debt, a sensitivity analysis can be performed of the EBITDA in terms of senior IRR, subordinated IRR, equity IRR and the overall project IRR. The difference in points at which the senior IRR and the junior IRR crosses is a measure of the risk. In the diagram below the case with more subordinated debt has more risk as demonstrated by the break-even points.

IRR on Senior versus Junior Debt with Different Capital Structures

- More Senior Debt



- More Subordinated Debt

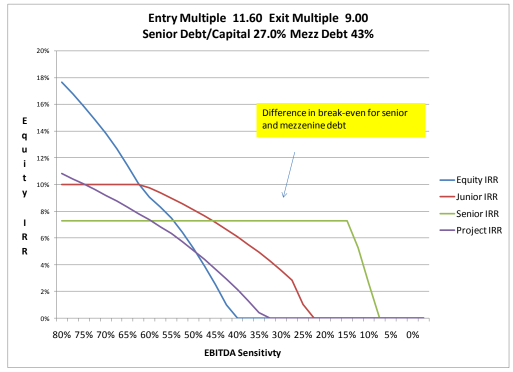


Figure 47

Chapter 10: Alternative Calculations of How Different Equity Shareholders can Receive Cash Flow -- Flips, Earn Outs and Management Incentives

Shareholder or partnership agreements may define the manner in which some investors receive a priority on cash flow available after debt in an analogous manner to the way in which loan agreements define priorities on cash flow before equity distributions. Some agreements may distribute dividends using complex formulas rather than simply allocating common dividends in a proportionate manner to all shareholders. These structures can involve a formula known as a flip where one group of shareholders is allocated the majority of dividends until a given IRR criteria is met. After achieving the IRR target, the dividend distribution scheme changes and the second investor receives a majority of the dividends. Other structures can allocate upside to management or to developers after some criteria is met. For example, management may receive 10% of the excess cash flow after a given IRR is obtained. Finally in acquisition transactions, earn out provisions can be established whereby a portion of the purchase price is allocated to existing owners, but they are only allowed to share in upside profits after a certain target is obtained.

The cash flow sharing that is part of shareholder agreements has analogies to cash flow waterfall applied to equity cash flow. In modelling a cash flow waterfall applied to equity distributions, the formula for receiving the dividends must be understood as is the case for priorities in the debt waterfall. If dividends are not distributed in a proportional manner, there must be some kind of trigger mechanism or formula that defines the distribution among investors. In some cases, selected investors can receive an implicit priority on cash flow either through a shareholder loan or the right to a higher proportion of dividends before some kind of target is met. As with the debt waterfall, cash flow to the investor that has the highest priority claims on cash flow can be modelled in an analogous manner to senior and subordinated debt. Complexity in modelling the equity cash flows can arise if the criterion for defining when senior equity cash flow depends on an IRR limit as described above. You could compute a rolling IRR that gradually increases as the project matures, but then you would have to allocate cash in the period in which the target IRR is obtained. In this period when the IRR has just been achieved, some of the cash flow is allocated to one investor and some is allocated to a second investor. A more accurate technique is to set-up a tracking account like a debt balance and then use the MIN function to compute dividends. A yield tracking account should be created when modelling a flip structure where a senior investor receives

a proportion of cash flows until an IRR yield is met, and a second investor receives the remainder of the cash and a different proportion after the yield is reached. Similar techniques can be applied to alternative equity structures including earn outs, management incentives and equity kickers. This process includes the following three steps:

First, input parameters for both the amount of the funding and the manner in which the dividends are paid as well as the criteria for the flip rate as illustrated in the table below.

Second, incorporate the funding proportions in the sources and uses account by multiplying the total amount of equity by the input percentages. The cash flow to the equity tranches are defined by the outflow from the funding relative to the cash inflows from the cash flow waterfall.

Partnership Inputs				Annual	Periodic
Class Sharing	Capital	Pre-Flip	Post-Flip	Flip Rate	Flip Rate
Class A	60%	80%	25%	9%	2%
Class B	40%	20%	75%		

Sources and Uses of Funds	
Uses of Funds	
Capital Expenditures	1,100,000
Less: Grant	306,900
Net Uses of Funds	793,100
Sources of Funds	
Class A Stock	475,860
Class B Stock	317,240
Total Sources of Funds	793,100

Figure 48

Third, set-up an equity tracking account, somewhat analogous to a debt balance account, that has a repayment section and reaches a level of zero once the IRR target is achieved. The yield tracking account keeps track of the balance due to the senior equity after taking account of the earnings that must be realized for the yield to be met. If the flip criteria is zero, the dividends would stop after the opening balance of the tracking account falls to zero. With a flip criteria, the cost of funding should be added to the opening balance so the total amount of payments to the senior equity results in the target IRR. The tracking account is similar to the other accounts except that the opening balance is increased by the yield that must be earned as illustrated below:

Opening Balance
Add: Earnings on Investment (Opening Balance x Required Yield)
Sub-total
Less: Dividends Distributed to Senior Partner
Closing Balance

Fourth, add a sub-total in the cash flow waterfall for the cash available to equity and use this sub-total line to evaluate the priority of dividends and how much cash is allocated to the different equity investors. The amount of that is received by the senior equity cash claim can be computed from the minimum of the cash flow subtotal multiplied by the dividend percent or the balance of the tracking account as demonstrated below.

Senior Equity Claim = MIN(Opening Balance of Tracking Account, Cash Flow x Percent)

Fifth, compute the junior equity claim cash flows before the flip period using a similar formula, except the cash flow is computed with the junior dividend percent instead of the senior percent.

Sixth, after the tracking account has been extinguished meaning the target IRR has been reached, apply the alternative dividend formula. This can be computed by creating another sub-total account and using this new sub-total as the basis for the alternative formula. The cash flow waterfall applied to tax equity using these sub-totals is illustrated below.

	A B C D	E	F	G	H	I	J	K	L	M	N	O
1	**Timing**											
2	Time Period				-1	0	1	2	3	4	5	6
144	Tax Equity Schedule			☐ Check								
145	Opening Balance				=H150---->	-	11,747.45	9,618.05	5,857.73	3,334.63	1,403.45	15.09
146	Add: Time Value of Money		7.50%		=I145*$F$146---->	-	881.06	721.35	439.33	250.10	105.26	1.13
147	Subtotal				=SUM(I145:I146)---->	-	12,628.51	10,339.40	6,297.06	3,584.73	1,508.71	16.22
148	Add: Drawdowns				=I127---->	11,747.45	-	-	-	-	-	-
149	Less: Dividends Received				=I182---->	-	3,010.46	4,481.67	2,962.43	2,181.27	1,493.63	16.06
150	Closing Balance					11,747.45	9,618.05	5,857.73	3,334.63	1,403.45	15.09	0.16
175	**Cash Flow Waterfall**	Base ▼										
176	EBITDA					-	1,010.61	1,026.84	1,046.85	1,067.12	1,087.66	1,108.48
177	Less: Taxes					-	(2,030.26)	(3,500.10)	(1,945.51)	(1,136.19)	(903.95)	(240.66)
178	Cash CFADS					-	3,040.87	4,526.94	2,992.36	2,203.31	1,991.61	1,349.14
179	Less: Debt Repayment					-	-	-	-	-	-	-
180	Less: Interest					-	-	-	-	-	-	-
181	Cash After Debt Service				=I178-I179-I180---->	-	3,040.87	4,526.94	2,992.36	2,203.31	1,991.61	1,349.14
182	Less: Tax Equity Dividends Pre-Flip		99%		=MAX(MIN(J181,J147),0)*$F$182---->	-	3,010.46	4,481.67	2,962.43	2,181.27	1,493.63	16.06
183	Less: Class 2 Equity Pre-Flip		1%		=MIN(MAX(I181,0)*$F$183,I147)---->	-	30.41	45.27	29.92	22.03	19.92	13.49
184	Cash Flow After Flip Period				=I181-I182-I183---->	-	0.00	0.00	0.00	0.00	478.07	1,319.60
185	Senior Equity Post Flip		1%		=I184*$F$185---->	-	0.00	0.00	0.00	0.00	4.78	13.20
186	Dividends to Class 2 Equity				=J184-J185---->	-	0.00	0.00	0.00	0.00	473.29	1,306.40

Figure 49

Chapter 11: The Last Step in Creating a Financial Model -- Putting Together Financial Statements and Tricky Issues in Calculating Income Taxes

Once a working module that computes revenues, expenses and working capital is established along with the depreciation schedule and the debt schedule, the profit and loss statement should be simple to put together. In a corporate model, the profit and loss statement is a central part of the results of a model as the net income defines the earnings per share and the return on equity. For a project finance model, earnings are not so important in presentation of the analysis, but calculation of the profit and loss statement is required to develop the line item for taxes paid that are used in the cash flow waterfall. A nice way to structure the profit and loss statement is to compute EBITDA after revenues are subtracted from cash operating expenses and then subtract various letters like DA to end up with E (earnings). The EBTIDA can be computed from the revenues and cash operating expenses (you often have to allocate depreciation expense to cost of goods sold and find depreciation on the cash flow statement or the financial statement notes). Depreciation and amortization (DA) can then be subtracted resulting to derive EBIT. This is very easy because the depreciation expense is already defined in the plant balance and depreciation section of your model. After computing EBIT, interest expense is subtracted and interest income is added resulting in EBT. As with depreciation expense, the interest expense and interest income is taken a module that you have already computed – this time from from the debt schedule. With EBT established, book taxes – the single calculation in the profit and loss statement that is not a subtotal -- are computed through multiplying the EBT by the tax rates and subtracting minority interest overall earnings can be computed.

The one calculation in the profit and loss statement that can be difficult is the calculation of cash taxes that are paid to the government. This calculation may seem very complicated, but it is not too painful if taxes are structured properly when setting-up a model. The computation of taxes can have an important effect on capital intensive projects such as renewable energy projects where rapid tax depreciation may be allowed, but the taxable income is not sufficient to use all of the tax deductions (including high levels of interest expense at the beginning of the modelling period.) As with the other mechanical issues regarding construction of a model one of the most important elements is simply not to be afraid to either read or construct the tax section of models. An effective way to compute taxes paid is to add a separate tax schedule after the profit and loss statement that lays out the taxes paid that are derived from a net

operating loss carryforward analysis. Incorrect computation of taxes paid and simplistic accounting for taxes may cause big problems in measurement of cash flow and valuation.

Not Being Intimidated by Computation of Taxes Paid and Taxes Deferred

A modelling process that you can use to compute taxes is to first compute the taxes recorded on the books and then later calculate the cash taxes actually paid. One of the things that may seem a little difficult is to incorporate net operating loss carry forwards. After the income statement is completed, the EBT from the income statement can be used as the first step for computing the true cash taxes that are actually paid (book taxes can be negative but actual taxes paid must be positive or zero). Starting with the book EBT, adjustments can be made that convert the EBT for books into the earnings before taxes for purposes of computing taxes paid. These adjustments may involve adding back book depreciation and then deducting tax depreciation, adjusting for intangible amortisation and other items related to the book accounting for derivatives. Once the adjustments for book versus tax expenses and income are made, the taxable income for purposes of computing cash taxes can be computed. This can then drive the calculation of net operating loss carry forward can be made. Computing net operating loss involves determining the balance of the net operating loss and making various adjustments that increase or decrease the carry forward balance that use very similar concepts to the cash flow waterfall with the MIN and MAX functions. When you have finished calculating taxes paid, you can also calculate the change in deferred taxes and the balance of accumulated deferred tax.

To compute taxes paid and an net operating loss carryforward, you can use the following step by step process in a module below the income statement.

Step 1: In the tax analysis, begin by creating a row that repeats the EBT from the income statement.

Step 2: Adjust the book EBT for depreciation and other items that cause cash taxes to differ from the taxes reported on the book profit and loss statement and derive a line item named EBT for taxes.

Step 3: Set-up an account that maintains the net operating loss balance (NOL) including the opening balance, the additions that occur from creating NOL when taxable income is negative and reductions in the NOL when the balance is used to reduce taxes that would otherwise be paid if there is positive taxable income.

Step 4: Compute the amounts deposited into the account from negative taxes through converting the negative amounts into positive numbers. As with the cash flow waterfall, use the MAX function to convert negative numbers into positive numbers and cap the negative numbers at zero.

Additions to NOL = MAX(-EBT,0)

Step 5: Calculate the amounts removed from the operating loss balance through determining the minimum of the opening balance and taxable income as was the case in evaluating cash flow items in the waterfall. This uses both the MIN and the MAX functions – the MIN function limits the use to the taxable income or the opening NOL balance.

Applications of NOL to Reduce Taxable Income = MAX(Min(Opening Balance, EBT))

Step 6: Compute the adjusted taxable income after adjusting for inflows and outflows from the operating loss account. Taxable income is increased by the additions to NOL and it is reduced by applications of NOE to reduce taxable income.

EBT After NOL = EBT for Tax + Additions to NOL – Application of NOL to Taxable Income

Step 7: Multiply the adjusted taxable income by the statutory tax rate to determine the cash taxes.

Step 8: Subtract the book taxes from the cash taxes to determine the change in accumulated deferred tax liability (when the book taxes are greater than taxes paid, the liability increases).

Step 9: Accumulate the deferred taxes through adding the changes in deferred taxes to the prior years balance. If the accumulated deferred taxes are positive, put the balance on the liability side of the balance sheet and if they are negative, change the sign and put the account on the asset side of the balance sheet.

These steps to compute taxes paid are illustrated on the excerpt below:

	C	E	F	G	H	I	J	K	M
1	Tax Rate	27.50%							
2									
3		1	2	3	4	5	6	7	
4	Book Income Statement								
5	EBT - Book	(500.0)	(300.0)	100.0	200.0	300.0	400.0	500.0	
6	Tax Expense	(137.5)	(82.5)	27.5	55.0	82.5	110.0	137.5	<---- =K5*Tax_Rate
7	Net Income	(362.5)	(217.5)	72.5	145.0	217.5	290.0	362.5	
8									
9	Tax Calculation								
10	EBT - Book	(500.0)	(300.0)	100.0	200.0	300.0	400.0	500.0	
11	Less: Added Depreciation for Tax	100.0	100.0	100.0	(100.0)	(100.0)	(100.0)	-	
12	EBT - Tax	(600.0)	(400.0)	-	300.0	400.0	500.0	500.0	
13									
14	NOL Balance								
15	Opening Balance	-	600.0	1,000.0	1,000.0	700.0	300.0	-	
16	Add: Tax Losses	600.0	400.0	-	-	-	-	-	<---- =MAX(-K12,0)
17	Less: Used NOL	-	-	-	300.0	400.0	300.0	-	<---- =MAX(0,MIN(K15,K12),0)
18	Closing Balance	600.0	1,000.0	1,000.0	700.0	300.0	-	-	
19									
20	Adjusted EBT	-	-	-	-	-	200.0	500.0	<---- =K12+K16-K17
21	Taxes Paid	-	-	-	-	-	55.0	137.5	<---- =K20*Tax_Rate
22									
23	Deferred Tax	(137.5)	(82.5)	27.5	55.0	82.5	55.0	-	<---- =K6-K21
24	Accumulated Deferred Tax	(137.5)	(220.0)	(192.5)	(137.5)	(55.0)	-	-	<---- =J24+K23
25									

Figure 50

If the tax law includes provisions whereby NOL can expire after a certain period of time, the calculations become of the NOL balance become more painful. The problem with expiring NOL is that one needs to look backwards to find when the NOL is lost and, more importantly, the expired NOL must not include NOL balances that have already been applied to taxable income. To compute this more complex NOL calculation, a three step process can be used beginning with the amount of NOL that would have expired had no NOL been used. This amount of NOL that was generated in prior periods does not represent the amount that will expire if some of the NOL has been used up. Therefore, the second step of the process is to accumulate the amount of the NOL that has been used up. The third step is to compare the amount of NOL that would expire with this accumulated amount. The adjustment to the expired NOL is the smaller of the amount of the accumulated used NOL or the amount that would expire without the NOL. The unadjusted expiry of the NOL is computed with the OFFSET function were the line item for the NOL created. Then a balance is made that adds the NOL applied to a balance and derives how much NOL is expired. The NOL expired is computed as the minimum of the opening balance or the amount that would expire.

	D	F	G	H	I	J	K	T
1								
2	Tax Rate	20%						
3	Maximum Carryforward Period	3						
4								
5		1	2	3	4	5	6	
6	EBT	-200	75	-90	40	10	-20	
7								
8	NOL Balance							
9	Opening Balance	-	200.0	125.0	215.0	50.0	40.0	<---- =Q14
10	Less: NOL Expired	-	-	-	125.0	-	40.0	<---- =R25
11	Adjusted Opeing Balance for test	-	200.0	125.0	90.0	50.0	-	<---- =R9-R10
12	Add: NOL Created from Loss	200.0	-	90.0	-	-	20.0	<---- =MAX(-R6,0)
13	Less: NOL Applied to Positive Income	-	75.0	-	40.0	10.0	-	<---- =MAX(MIN(R11,R6),0)
14	Closing Balance	200.0	125.0	215.0	50.0	40.0	20.0	<---- =R11+R12-R13
15								
16	Calculation of Expired NOL							
17	NOL Expired Before Adjustment for NOL Used	-	-	-	200.0	-	90.0	<---- =IF(R5>$F$3,OFFSET(R12,0,-$F$3),0)
18								
19	Accumulated Adjustment for Expired NOL							
20	Opening Balance	-	-	75.0	75.0	40.0	50.0	<---- =Q23
21	Add: NOL Already Used	-	75.0	-	40.0	10.0	-	<---- =R13
22	Less: Reduction in NOL Expired from NOL Used	-	-	-	75.0	-	50.0	<---- =MIN(R20,R17)
23	Closing Balance	-	75.0	75.0	40.0	50.0	-	
24								
25	Expired NOL: Unadjusted Less Reduction	-	-	-	125.0	-	40.0	<---- =R17-R22
26								

Figure 51

Cash Flow Statement and Balance Sheet

The structure of all of the financial model types includes a cash flow statement and a balance sheet as the final part of the model structure. Complicated issues associated with the cash flow statement were discussed above in the context of the cash flow waterfall and the cash flow statement should have a similar presentation to the cash flow waterfall. Other than the cash flow waterfall, programming the cash flow statement and the balance sheet simply involves linking the rows with other calculations that have already been made. The only calculation that is not a simple sub-total in a cash flow statement is for dividends. A separate section is included for these parts of the model in order to be comprehensive and because of the importance of structuring the sheet.

Most of the time it is better to begin a cash flow statement with revenues, expenses and EBITDA rather than net income. If net income is the starting point, then interest expense and interest income are already included in net income. To compute a cash flow waterfall, the senior interest may have to be separated from subordinated interest expense and interest income generally is available for cash flow. Other than the MIN and MAX statements that are used to define the cash flow priorities every item on the cash flow is either a sub-total or directly comes from the debt schedule, the income statement, the working capital module and other places. The end of the cash flow statement is different depending on the type of model. For corporate models and integrated models, the dividends are included in the financing section of the model and the end of the cash flow statement is surplus or deficit cash flow that feeds into the short-term debt and the surplus cash. In the case of project finance models and acquisition models, changes in cash are included as required reserve accounts such as the debt service reserve account and the last line is the dividend distribution.

Other than the model outputs and the risk analysis, the last part of a model is computation of the balance sheet. For people who have done a lot of modelling, seeing the balance sheet balance is a wonderful feeling. To the contrary, not being able to find where the balance sheet has gone wrong gives you a nasty taste. For the balance sheet to be an effective auditing tool, each item in the balance sheet should be already computed in the model and you should simply find all of the closing balances and link them to the balance sheet. The balance of accounts receivable, cash, plant, debt should already exist. For other assets on the balance sheet that are not modelled in detail such as investments, debt issuance cost

associated with capitalized underwriting fees and operating reserve accounts, balances should be established. A separate account can be created for the book balance of assets and the tax balance of assets if there is a difference in depreciation methods or in the basis for depreciation. The balance of equity capital that includes the effects of net income and dividends should be presented before the balance sheet but after the cash flow statement as illustrated below. A similar presentation should be made for minority interest which derives items from the balance sheet and the cash flow statement.

Start of period ☐ Show Comments Fix	01-mars-13	01-avr-13	01-mai-13	01-nov-13	01-mai-14	01-nov-14	01-mai-15	01-nov-15	01-mai-16	01-nov-16	01-mai-17	01-nov-17	01-mai-18
End of period	31-mars-13	30-avr-13	31-oct-13	30-avr-14	31-oct-14	30-avr-15	31-oct-15	30-avr-16	31-oct-16	30-avr-17	31-oct-17	30-avr-18	31-oct-18
Year	2013	2013	2013	2014	2014	2015	2015	2016	2016	2017	2017	2018	2018
Equty Balance													
Opening Balance	51,879.22	52,648.47	57,257.15	46,643.11	36,029.07	28,290.28	20,619.79	15,114.21	9,608.64	5,842.41	2,132.07	-284.43	-2,700.92
Add: Funding	769.25	4,608.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Add: Income	0.00	0.00	-8,653.14	-8,148.09	-5,025.37	-4,677.37	-2,247.15	-2,161.25	67.49	-162.15	1,420.48	1,470.34	2,864.25
Less: Dividends	0.00	0.00	1,960.90	2,465.96	2,713.42	2,993.12	3,258.42	3,344.33	3,833.71	3,548.19	3,836.98	3,886.83	4,688.88
Closing Balance	52,648.47	57,257.15	46,643.11	36,029.07	28,290.28	20,619.79	15,114.21	9,608.64	5,842.41	2,132.07	-284.43	-2,700.92	-4,525.56
Assets													
DSRA Balance	0.00	3,936.08	3,880.20	3,824.33	3,768.45	3,780.87	3,721.89	3,662.91	3,603.93	3,600.83	3,538.75	3,476.66	3,414.58
Lockup Balance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Plant Base	112,334.93	113,400.00	100,800.00	88,200.00	78,400.00	68,600.00	60,977.78	53,355.56	47,427.16	41,498.77	36,887.79	32,276.82	28,242.22
Net Plant IDC	2,834.79	3,047.99	2,709.32	2,370.66	2,107.25	1,843.84	1,638.97	1,434.10	1,274.76	1,115.41	991.48	867.54	759.10
Unamortised Fees	1,438.91	1,439.67	1,336.83	1,234.00	1,131.17	1,028.33	925.50	822.67	719.83	617.00	514.17	411.33	308.50
Total	116,608.63	121,823.73	108,726.36	95,628.99	85,406.87	75,253.05	67,264.14	59,275.24	53,025.68	46,832.01	41,932.18	37,032.36	32,724.39
Liabilities and Capital													
Construction Debt	63,960.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Permanent Debt	0.00	64,566.58	62,083.25	59,599.92	57,116.59	54,633.26	52,149.93	49,666.60	47,183.27	44,699.94	42,216.61	39,733.28	37,249.95
Re-financed Debt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Defaulted Debt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity	52,648.47	57,257.15	46,643.11	36,029.07	28,290.28	20,619.79	15,114.21	9,608.64	5,842.41	2,132.07	-284.43	-2,700.92	-4,525.56
Total	116,608.63	121,823.73	108,726.36	95,628.99	85,406.87	75,253.05	67,264.14	59,275.24	53,025.68	46,832.01	41,932.18	37,032.36	32,724.39
Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Test	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE

Figure 52